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June, 1928

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A Shop Practice Magazine

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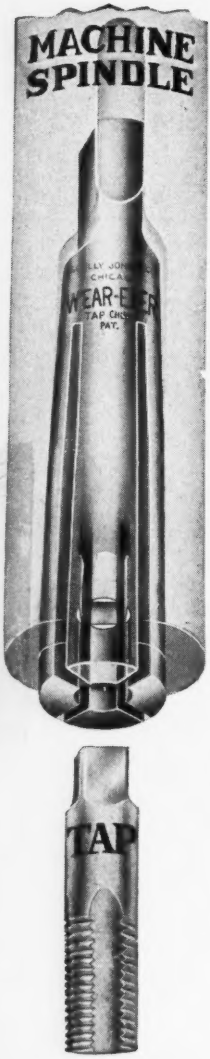

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To Our Readers

IT is a pleasure to present you with this copy of the first issue of MODERN MACHINE SHOP—a new magazine in the metal-working field, and one that is dedicated to the interests of the mechanical executives in this most important basic industry.

¶ The mechanical arts have been developing throughout the past few years with ever-increasing speed, and the number of machine shops now in operation is far greater than it has ever been in peace time. New machines, new metals, new processes, and new methods are being developed almost over night, and the progressive mechanical executive is constantly seeking reliable sources of information regarding his field.

¶ This situation has created a demand for information and education which has been interpreted by the publishers of MODERN MACHINE SHOP as an opportunity for service, and the responsibility for this service will be assumed in the best manner that many years of experience in the field can dictate.

¶ The Publisher and General Manager of MODERN MACHINE SHOP is Don G. Gardner, who has for the last eight years been Southwestern Manager for The Iron Age. Howard Campbell, who will manage the editorial department, was Western Field Editor for the American Machinist for four years, Editor of Motor Service for two years, and more recently has been serving as a special writer on engineering subjects. Mr. Campbell's practical plant experience extended over a period of thirteen years,

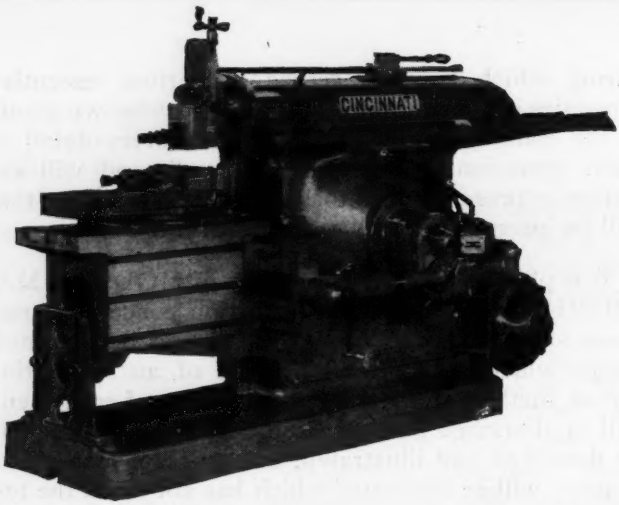
during which time he served in various executive capacities in some of the largest and best-known plants in the country. He is familiar with every detail of plant operation, both large and small, and will endeavor to present the editorial matter in a manner that will be interesting to all readers alike.

¶ It is planned to give the readers of MODERN MACHINE SHOP the best information concerning machine shop tools and methods that can be obtained. Shops which are unusual because of an interesting layout, method of operation, or selection of equipment, will be described in each issue. New equipment will be described and illustrated, but no plan, method, or practice will be advocated which has not stood the test of time and experience. In short, the principal function of MODERN MACHINE SHOP will be to search out and disseminate the best and newest ideas for the advancement of engineering skill and mechanical efficiency in the metal-working industry, and neither effort nor expense will be spared in the performance of this task.

¶ This magazine is YOUR magazine, published to help you in solving YOUR problems, and we ask your support and co-operation.

Publisher.

Editor.



The Shaper Becomes More and More Prominent as Refinements Increase Its Usefulness

TODAY the shaper has a definite place in manufacturing. Hundreds of small planing jobs don't lend themselves to milling or through planing and it doesn't take special tools or fixtures to do them on a shaper.

Again the shaper has an essential place in repair and maintenance shops where a piece of any size or shape may be called for at a moment's notice—no time for special cutters—no time for anything except to machine whatever stock is available on the ever-ready shaper.

For tool and die work the shaper is indispensable. Special tools, jigs, fixtures, forging dies, blanking dies, die blocks, bolsters—all are like repair parts in their special features. Here the shaper comes into play, either for hogging off metal or to finish with a hair line cut. Flat, parallel, square, accurate, true—must be the verdict on this work, and the simplest tool to meet these standards is the shaper.

Cincinnati Shapers have added to the popularity of shapers in general by introducing to the shaper world such important features as automatic oiling, cam feeds, internal transmission, and direct reading indicators for all adjustments. Shapers have always held a recognized place among machine tools, but Cincinnati Shapers have taken the lead in establishing for them an even higher standing among the Master Tools of Industry.

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Don G. Gardner
Publisher

Howard Campbell
Editor

MODERN Machine Shop

A MAGAZINE FOR MACHINE SHOP EXECUTIVES
Published monthly at 128 Opera Place, Cincinnati, Ohio

Vol. I JUNE, 1928 No. 1

CONTENTS

	Page
A Message to Our Readers	2
Building "HB" Products *By Howard Campbell*	7
Machining Composition Gears *By R. W. Lytle*	12
A Foremen's Club That Produces	20
The Heat Treatment of Steel Parts *By A. S. Irvine*	28
"Offset" Milling *By Gordon Keith*	34
Ideas From Readers	38
The Editor's Page	44
New Shop Equipment	46
Mensuration Factors	59
Table of Twist Drill and Drill Rod Sizes	60
Table of Regular Polygons	61
Index to Advertisements	62
Riff Raff Ravings	64

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MODERN Machine Shop

Cincinnati, Ohio JUNE, 1928 Vol. I, No. 1

Building "HB" Products

By HOWARD CAMPBELL

THE first impression that comes to the visitor in the plant of the Hobart Brothers Company, Troy, Ohio, is one of neatness and order. The shop floors are clean; all scrap and shavings either fall or are immediately put into receptacles provided for that purpose; jigs, fixtures, and tools are placed on tables or benches, and the stock is arranged in neat piles in areas that are marked off with white paint on the floor.

It is a well-known fact that the general appearance of a shop usually indicates the quality of the work that is turned out there, and that fact may be responsible to some extent for the growth and success of this company. Five years ago the shop force numbered approximately fifty men; today there are more than 250 men required to keep the output even with the orders. The business was founded on the manufacture of battery-charging equipment, but as the demand for air compressors and car washing outfits developed, the manufacture of these units was taken up. The quality of the product, coupled with an extensive advertising campaign, has brought in

Fig. 1.—Castings are "snagged" on their way to the shop.

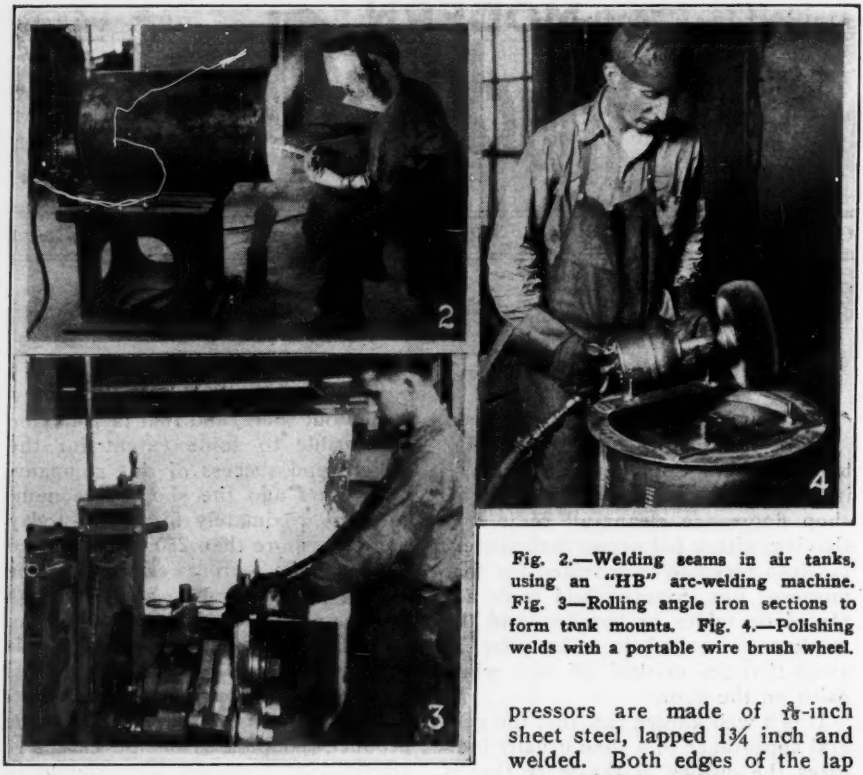


Fig. 2.—Welding seams in air tanks, using an "HB" arc-welding machine. Fig. 3—Rolling angle iron sections to form tank mounts. Fig. 4.—Polishing welds with a portable wire brush wheel.

more orders than the company is able to fill at the present time and another addition to the plant is under construction.

Castings come into the plant from the rough inspection room by way of two roller conveyors, both of which pass within easy reach of the rough grinding and disk grinding machines, shown in Fig. 1. Here the gates, fins, and other "snags" are removed so that the castings can be machined without delay. Sheet metal and bar stock also come into the shop at this end.

A large amount of electric welding is done in this plant, for which several booths similar to that shown in Fig. 2 are provided. Tanks for air compressors are made of $\frac{3}{16}$-inch sheet steel, lapped $1\frac{3}{4}$ inch and welded. Both edges of the lap are welded, in addition to which the seam is riveted in order to comply with the requirements of the various State laws. A seam in the tank shown, which is 30 inches long, can be welded in six minutes. A Hobart "HB" arc-welding machine is used.

The end of the tank is reinforced with a "tank mount," which is a section of $1\frac{1}{2}$x2x$\frac{3}{16}$-inch angle iron, rolled to form a circle. After the section is cut to length, it is formed in the machine shown in Fig. 3. The section is usually cut long enough to form three rings, then they are cut apart and the two ends of each section are welded together to form a complete ring. Twenty rings per minute can be rolled to shape with this machine.

The vertical type of compressor is built with the compressor mounted on top of the tank, the machine being bolted to two steel straps which are electrically-welded to the tank mount, as shown in Fig. 4. Here a mechanic is shown polishing the welds with a Keller portable wire brush wheel, preparatory to painting.

Crankcases for the air compressors are bored, faced, and reamed on a King boring mill, shown in Fig. 5. The crankshaft bearings are bored and reamed to size, and the bosses are faced both inside and outside to a given dimension, the entire operation requiring 20 minutes from floor to floor. An adjustable Pratt & Whitney reamer is used, which can be set to size in a few seconds if it starts to wear.

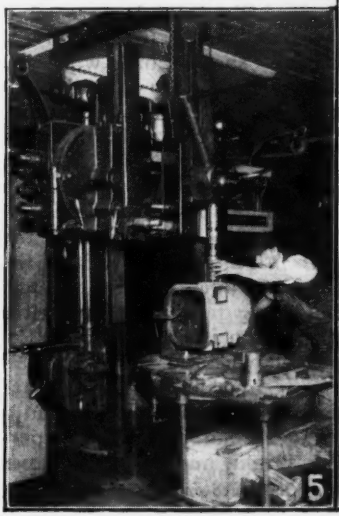
The next operation on the compressor crankcase is that of facing off the end, turning a seat for the motor housing, and boring the end bearing, which is done on the Warner & Swasey turret lathe, shown in Fig. 6. With two tools in the cross-slide and a boring bar in the turret, all three operations are performed at once in this machine.

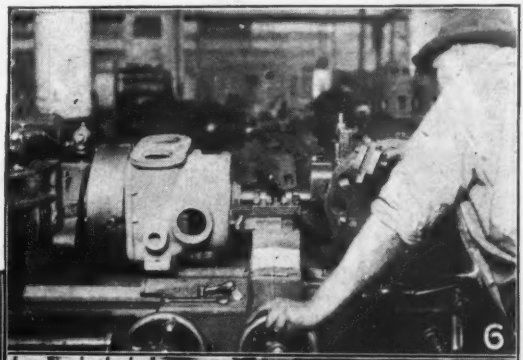
One of the most interesting operations in the shop is the milling of the sides of the motor housings and crankcases, which is done on an Ingersoll milling machine, Fig. 7. The parts are designed so that the dimensions are the same on both pieces, making it possible to set eight pieces of each kind on the table of the machine and

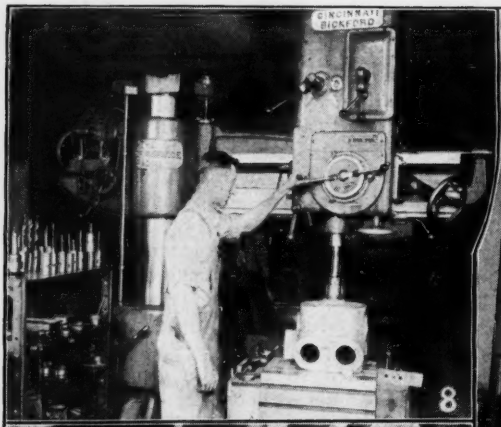
Fig. 5—Crankcases for air compressors are machined on a King boring mill.

Fig. 6—Boring, facing and turning the end of the crankcase.

Fig. 7—Machining two kinds of castings in the same operation.







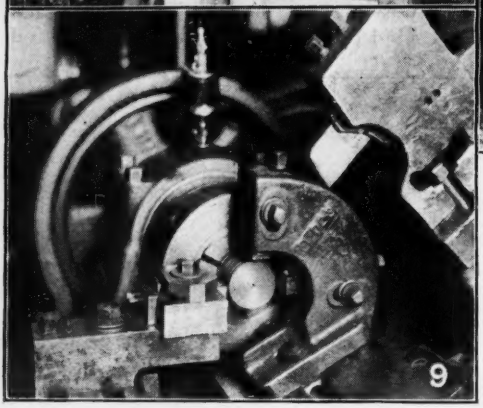


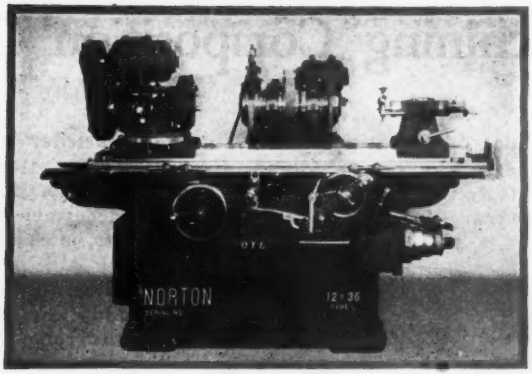
Fig. 8—Crankcases are reamed, drilled, and tapped on the Super Service Radial.
Fig. 9—Turning 2-inch pistons in a Gridley automatic.
Fig. 10—Drilling air compressor heads.

machine them at one setting. Three cutters are provided at the front of the cross-head for roughing, the finishing cuts being taken by two cutters at the rear. This method of handling the job keeps an even number of castings of both kinds in process, a production of 150 castings of each kind per day being maintained.

The end bearing is finish-bored and reamed, and the thirty-four holes by which the crankcase is attached to the motor housing are drilled and tapped on a Cincinnati-Bickford "Super Service Radial," Fig. 8. With a machine which can be instantly changed from the high speeds required for the small drills to a low reaming speed and again to the correct tapping speed, and with his tools arranged in orderly sequence, as shown in the illustration, the operator is able to turn out a maximum of production.

The little 2-inch pistons used in the small air compressors are machined in Gridley automatic lathes, such as the one shown in Fig. 9. Both ends of the piston are machined in Gridleys, the open end being machined first, after which the piston is chucked from the inside, as shown, and the outside is turned, faced, and the ring grooves are cut, the entire operation being automatic. The second operation is performed in eight minutes and leaves

(*Continued on page 58*)



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Machining Composition Gears

By R. W. Lytle*

GEARS made of composition materials have been in use for a number of years, but it has only been in the last few years that the application of such gears has become general. The fast-growing demand for them at the present time is probably due to the necessity for quiet gears in automobile motors, and to a comparatively recent recognition of the fact that the noise and clatter of machinery in industrial plants affects the nerves—and therefore the efficiency—of the workers. Each year more attention is being focused upon the matter of the elimination of unnecessary noise in manufacturing plants, most of which is caused by gears.

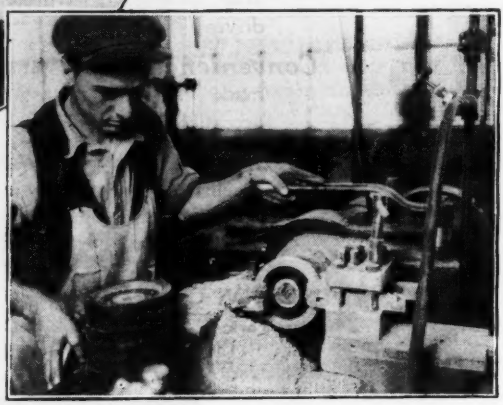

Fig. 1—Blanking out laminations of impregnated cotton duck. The laminations are assembled and fused under tremendous pressure at high heat. Fig. 2—Turning, facing both sides of rim, and facing hub of a gear blank in one operation in a LeBlond lathe. The gear is held by an expanding mandrel, operated by an air-chuck.

The positive drive which gearing affords cannot be eliminated, therefore the remedy lay in the development of a non-metallic material which would lack the resonance of metal, while at the same time having the necessary strength to carry the required load without failure. An added problem was presented by the necessity for a material which would resist the action of acids and alkalies, which could be used in fumes, steam and oil without deteriorating, and which could be stored indefinitely without loss of accuracy in dimension.

After many years of research and investigation, it was found that textile

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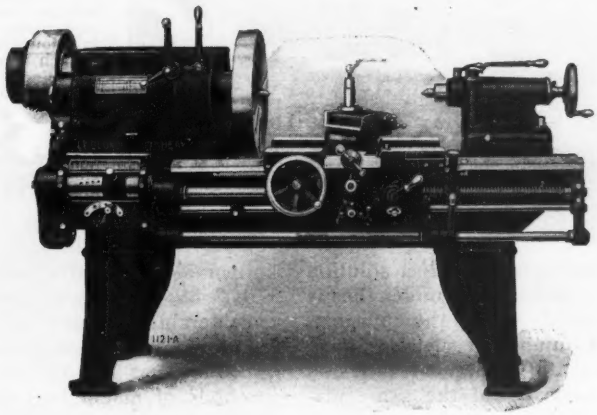

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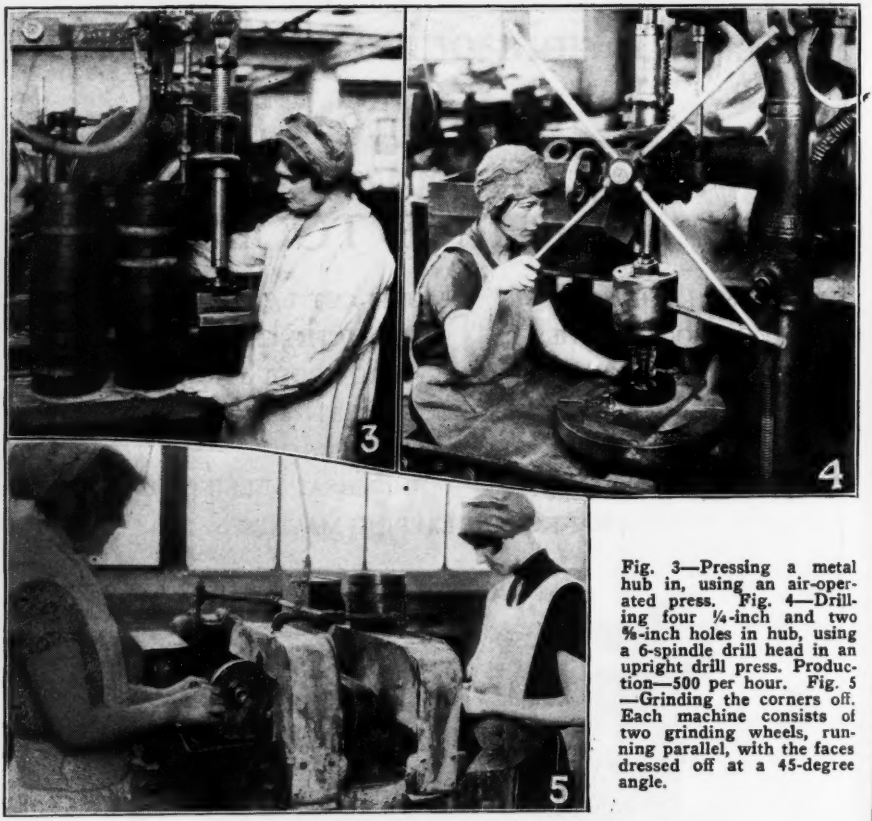

Fig. 3—Pressing a metal hub in, using an air-operated press. Fig. 4—Drilling four ¼-inch and two ⅝-inch holes in hub, using a 6-spindle drill head in an upright drill press. Production—500 per hour. Fig. 5—Grinding the corners off. Each machine consists of two grinding wheels, running parallel, with the faces dressed off at a 45-degree angle.

materials impregnated with a solution of Bakelite and baked under heavy pressure would serve the purpose. There are a number of such compositions in use at the present time, all consisting basically of the same materials, but differing more or less in the manner of compounding. Gears made of the compositions are marketed under various trade names, and are used in the manufacture of all kinds of machinery, from enormous paper-making machines and steel mill machinery down to phonographs, washing machines, vacuum cleaners, and so on.

Thus the use of these compositions, known as "laminated phenolic materials," has become so general that a considerable amount of interest has been aroused among machine shop executives as to the most efficient methods of machining, types of tools used, speeds, feeds, and other details of production. The figures quoted in this article will refer to the material known as "Formica," which is an excellent example of materials of this type.

Generally speaking, the tools used for the machining of laminated phenolic materials should be ground in the same manner as tools for machining metals, with the exception that there

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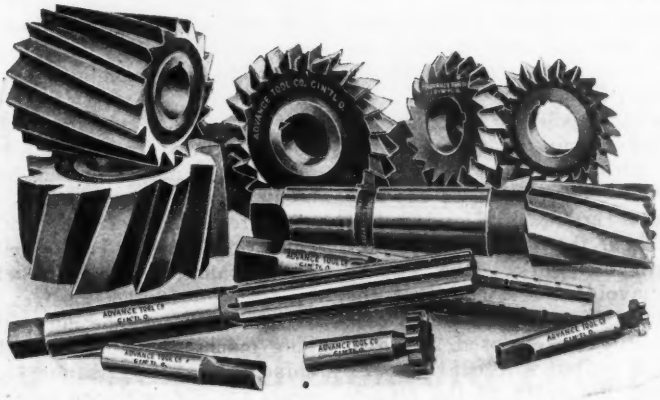

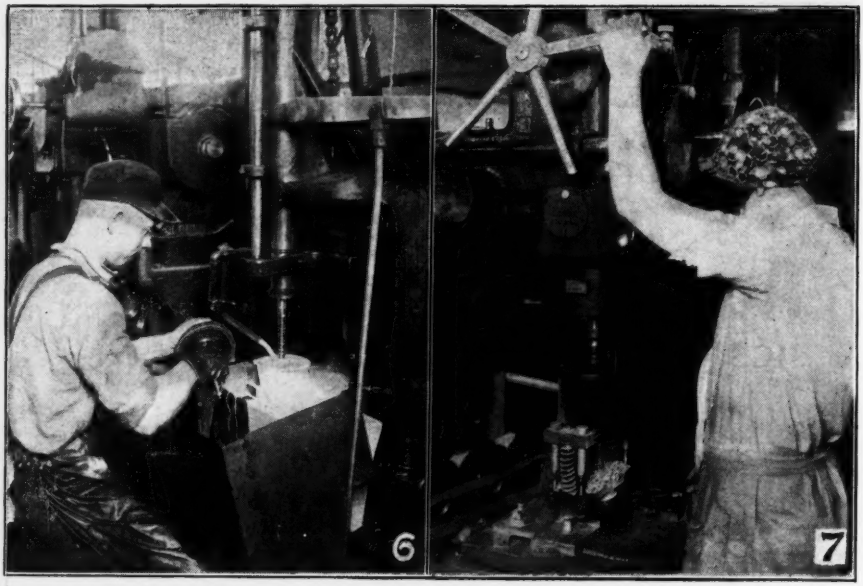

Fig. 6—Broaching a ⅞-inch hole in the hub. The hydraulic broaching machine pushes a 21-tooth broach through the hole at a rate of 360 per hour. The operator starts one broach by hand, while the other is in process. Fig. 7—Two ⅝-inch clearance holes are drilled at a rate of 360 per hour. A Colburn machine and multiple drill head are used. The jig automatically releases the piece when the drill spindle releases.

should be more draft or clearance to the cutting edges. Cutting speeds should be five times the speed used in cast iron, and should never be less than 300 feet per minute. Drills should be ground with five degrees more taper than is used for steel, or 55 degrees included angle.

An important point to remember in drilling and reaming is that the tool must be withdrawn from the work immediately it is through, as the material heats very quickly and unless care is taken, the tool will stick or "freeze" in the work. One way in which to avoid this is to grind the drill slightly off center, in which case a smaller drill must be used, as a drill ground off center will cut oversize. In reaming, the entry of the reamer and the process must be rapid and there should be no lagging between the finish of the hole and the exit of the reamer.

Tools used for turning must be kept sharp and should have from three to five degrees more rake than is common practice for metal. Work speeds up to 750 feet per minute can be used successfully, although from 300 to 500 feet are the speeds most commonly used. A cut of from $\frac{1}{16}$ inch to ⅛ inch may be taken as required, but a feed of .020 inch per revolution should be used, regardless of the depth of the cut. Tools must be ground with plenty of clearance, so that the chips will immediately free themselves.

Gear-teeth may be cut with a hobbing machine, shaper, or milling machine, in the same manner that metal gears are cut, with the exception that the cutting speeds are higher. A cutter-speed of 150 feet per minute

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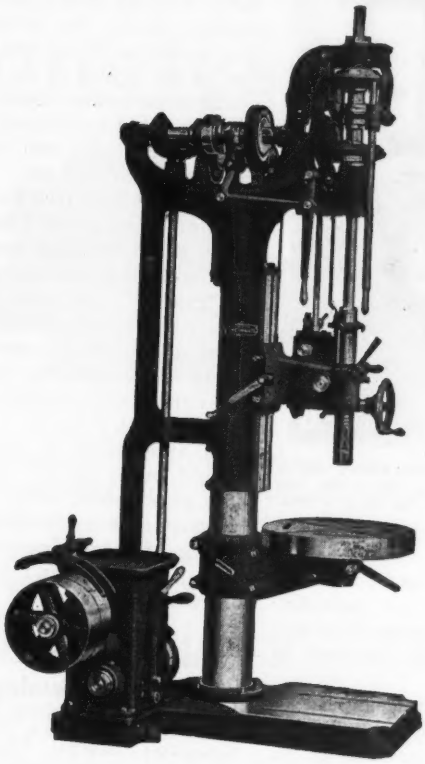

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should be used, with a feed of from .023 inch to .040 inch per revolution of the cutter, as required. When the

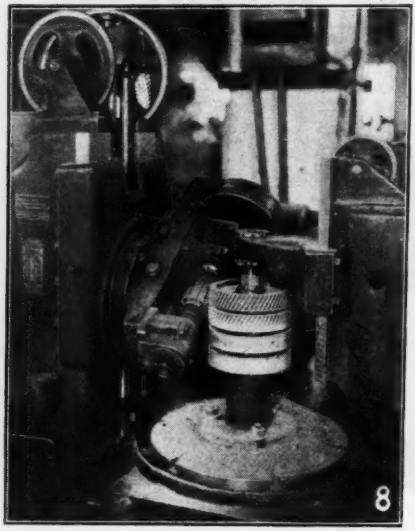

Fig. 8—Hobbing teeth in Formica timing gears. Only four gears are shown on this arbor, but as many as nine are sometimes put on at a load.

design of the hub will permit, it is good practice to cut gears in multiple in as large quantities as possible, within the capacity of the machine and within the capacity of the mandrel to hold the work rigid.

The last or bottom blank should always be backed up to prevent fraying or breaking out of the material as the cutter comes through. The backing plates can be made of hard wood, although for production purposes a metal plate that can be rotated by the operator so that it can be set in position to back the teeth up after the arbor has been set in the machine is generally used, as it will last indefinitely.

In cutting and assembling the gears, provision must be made to allow for the increase in dimension due to expansion from heat while in operation. As the expansion of the composition is nearly twice that of cast iron at the same temperatures, this is an important matter. Sufficient backlash should be allowed to eliminate the possibility of the teeth wedging on the pitch line, as wedging will quickly destroy the tooth spacing and contour, and will rapidly reduce the ultimate satisfactory working life of any gear, regardless of the nature of the material from which it is made. Gears of any kind that are fitted too closely together will spring the shafts and ruin the bearings.

The machines used for cutting composition gears should have well-fitted bearings, as the high speeds and feeds used will otherwise cause the machine to "chatter" and poor work will result. Hobs should be carefully inspected for tooth accuracy; inaccurately or irregularly shaped teeth in the cutter will produce waves on the pitch line of the gear.

In assembling, a composition gear should never be hit with a hammer. The gear should either be pressed on or driven on by holding a section of tubing of large diameter against the face of the gear and striking the tubing with a hammer.

Scully-Jones & Co. Issue New Catalog

Scully-Jones & Co., 1901 South Rockwell Street, Chicago, Ill., announces a new issue of their Small Tool Catalog No. 36, which supersedes all previous issues and contains a number of additions to their present line of production tools. The line includes tools for drilling, tapping, reaming, milling, counterboring, spotfacing, and for other operations. In addition to the descriptive matter, the catalog contains practical suggestions and reference data which should be useful to both executives and mechanics. Copy furnished free on request.

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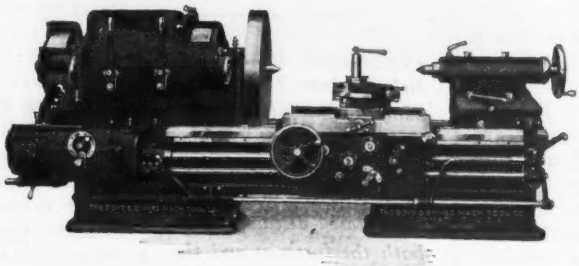
BOYE & EMMES

Coneless Lathe

(TRADE-MARK REGISTERED)



will meet all requirements. Highest spindle speed is lower than initial drive shaft speed and there is no step-up speed in any gear combination, assuring maximum of power at the cutting tool. Built for

Speed :: Rigidity :: Durability

this lathe can be depended on for accuracy and service, year in and year out, without repairing or rebuilding at frequent intervals. A better lathe, but the first cost is the only cost. "The Lathe with the Long Life" is built in

Sizes from 18-inch to 36-inch Swing

Either belt or motor drive — Ask for descriptive circular.

THE BOYE & EMMES MACHINE TOOL CO.

2247 Spring Grove Avenue CINCINNATI, OHIO

A Foremen's Club That Produces

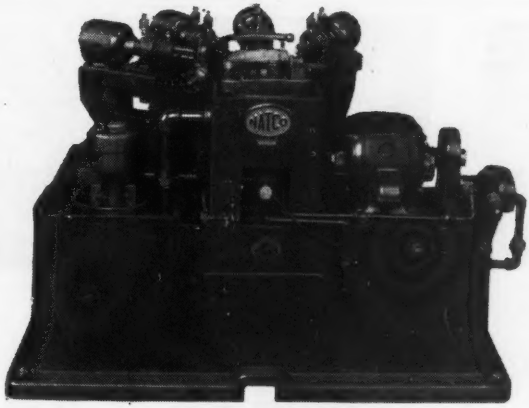
A FOREMEN'S club that gets results—both for themselves and for the company—has been found. That statement will probably be received with a grin by most of the foremen who have sat in foremen's meetings time after time and have seen the meetings close with the usual negative amount accomplished. Foremen's meetings are usually looked upon by the foremen as a waste of perfectly good time, and very often they are right. Why a superintendent will get all of his department heads together and then let two or three of the gathering use up the entire allotted time in passing the buck back and forth on matters that could be better settled some other time, no one knows, but nearly every foreman or superintendent who has sat in a foremen's meeting has had the same experience.

The foremen of the Fosdick Machine Tool Company formed their own club, and hold regular meetings that produce results. Subjects of practical value are discussed and both the foremen and the company have benefitted.

The foremen of the Fosdick Machine Tool Company formed their own club some time ago, and such thoroughly practical and beneficial results have been outlined that the meetings are looked forward to with keen interest. The object of the club is research in mechanical or engineering matters, and each foreman has the advice and help of all the others in solving theoretical or actual problems. Matters of production, uses of equipment, tools, and so on, are brought up for discussion, and each member of the club leaves the meeting feeling that he has learned something.

The club meets once a month, and at each meeting the president of the club appoints a committee to select the topics for discussion at the next meeting. This committee must investigate any equipment that is to be discussed, obtain figures on production on the tool or machine under discussion, comparative figures on any suggested tool or machine, data on any extra equipment involved, and so on. If a foreman has a job in his department with which he is having a great deal of trouble, he may bring the matter to the attention of the committee, who then investigate the job and bring the subject before the club for discussion. If various methods or remedies are suggested, notes are made of the suggestions and they are given a trial in due time. In order that the discussions should be systematic and orderly, a set of rules adapted from parliamentary law was adopted for the conduct of the meetings.

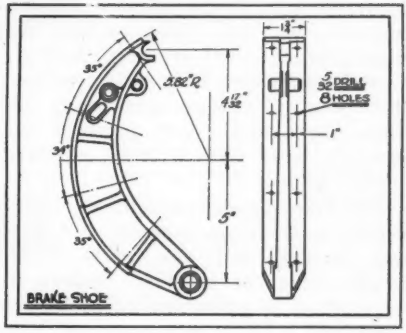
The case of a drill grinder which stood idle will serve as an illustration of the manner in which some of the subjects are handled. The grinder had stood idle for many months, due to the fact that it would not grind a drill correctly. A committee com-



750 BRAKE SHOES DRILLED PER HOUR!

THE above illustration shows a 4-Way Special Hydraulic Machine built of four 2-spindle direct motor driven sliding heads controlled by one central hydraulic cylinder.

This Machine drills eight 5/32 inch holes in a die cast brake shoe which is shown at right. Machines of this type can easily be changed for various angles, number and sizes of holes.



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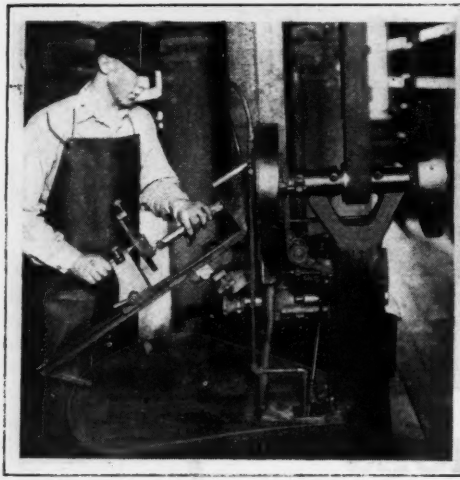
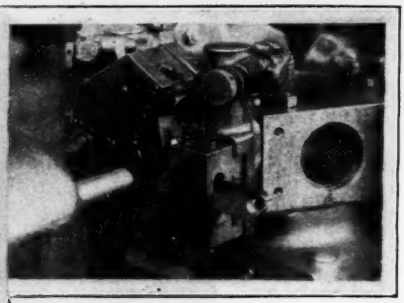
Single Purpose Auto.
Hiduty Single Spindle
Horizontal Duplex
Drill Heads
Universal Joints
Quick Change Holders
Rotary Tables and Fixtures
Drillers
Tappers
Special Machines

May we give you a proposition on your holes?

THE NATIONAL AUTOMATIC TOOL CO.

RICHMOND, INDIANA, U. S. A.





(Left)—The addition of new parts brought this old machine up to date. (Above)—All this machine needed was the right kind of tool to make it serviceable.

posed of the foreman of the drill press department, foreman of the erecting department, and the shop designing engineer, was appointed to find out what ailed the drill grinder. A short investigation disclosed that the machine was out of date—practically obsolete—and would not produce the accurate work that is now standard in that plant.

The first suggestion made was that a new machine be ordered. Then it was decided that new parts which would make the machine modern in its method of operation could be applied, and a figure was obtained from the factory on the cost of shipping the machine there to have the new parts put on and the machine returned. Further inquiry disclosed the fact that the parts could be purchased and put on by the workmen in the Fosdick plant, at a considerable saving, which was done. This method of handling the job made it possible to have the machine in operation a week sooner than it would have been otherwise, and a saving of $13.65 was made. In determining cost of this renewal, a charge was made for overhead.

Another machine that had stood idle for some time was a screw machine. This machine would not produce good work, the foreman said, because the chips curled around the work and interfered with the guiding rollers, resulting in all kinds of diameters where the work should be held to a close dimension. Various kinds of tools were made up and tried without result, then a letter was written to the manufacturers of the machine—an English firm—who sent a tool that could be used. The tool is formed quite differently from the usual screw machine or lathe tool, but it curls the chip in such a way that it keeps free from the work and rollers. The machine hadn't been used for several years on this class of work before the club took it up as a subject; now there are five jobs on this character that are done on this machine, keeping it in almost constant use. In that case, a direct saving was made of one good machine.

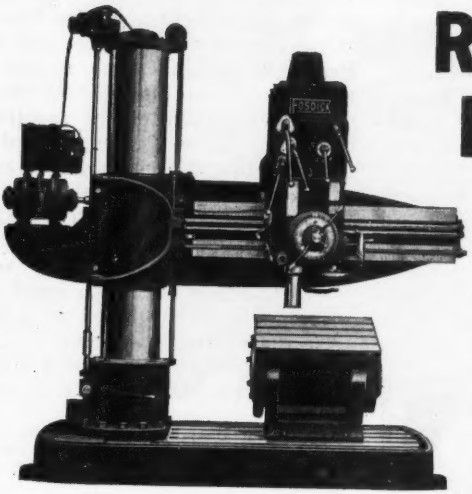
The foreman of one department brought up the subject of a swing-grinder that was used to grind rough castings and upon which, he said, it was almost impossible to keep an operator. The men complained that the machine was hard to handle, re-

For *HEAVY DUTY DRILLING*

THE NEW

FOSDICK "ECONOMAX"

3 Ft.—4 Ft.—5 Ft.—6 Ft.—7 Ft.



RADIAL DRILL

IS THE IDEAL MACHINE

The most modern and up-to-date developments in engineering practice are incorporated in the design of this machine.

Consider these Special Fosdick Features:

Universal control at head—36 spindle speeds—Hardened alloy steel driving gears—Automatic lubrication—Tapered roller bearings—Extra large alloy steel spindle with six multiple splines—High pressure lubrication of spindle—Power rapid traverse of head on arm with friction drive—Tilting table with rigid clamping at all angles—18 feeds and 3 pipe-tap leads—Quick return of spindle—Dial divided into even inches—Tapping and driving mechanisms with indestructible multiple disc frictions—Taper roller bearing in loose pulley (if pulley drive)—Only one motor for elevating, head traverse, and driving spindle (if motor drive.) AC or DC.

THE FOSDICK MACHINE TOOL COMPANY

CINCINNATI, OHIO

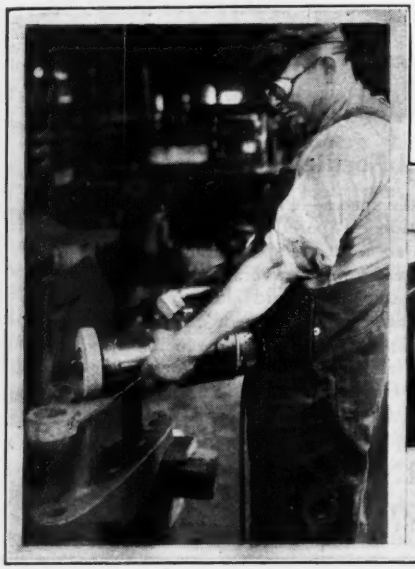
quiring too much labor, and consequently they could not be kept on the job. After the usual discussion, the members agreed that the best solution to the problem was the purchase of a portable electric grinder. Such a grinder was purchased and there has been no further trouble with the job.

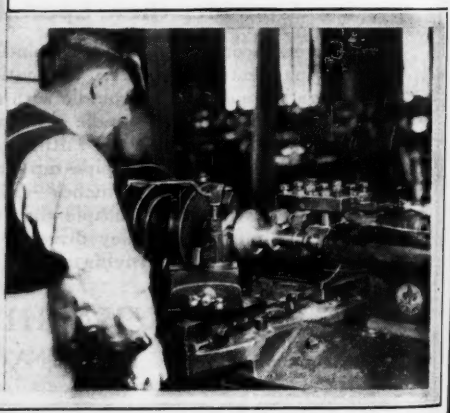
A production problem that was laid before the club was the machining of drill heads upon which the operations were as follows: milling for the dovetail, inspection for the milling operation, and drilling and reaming for a clamp. When these heads were received in the scraping department, some of them were found to be so small in the dovetail that they could not be scraped in a reasonable length of time.

An investigation by the club brought up the question as to whether or not the slot allowed the casting to change in seasoning. It was found eventually that in the drilling operation the pressure of the drill point on the work was sufficient to close up the slot in the dovetail to a more or less extent. A test showed that the pressure on the point of the drill amounts to approximately 620 pounds. The operations were changed so that that piece is now drilled before it is slotted, and the trouble has disappeared.

A semi-automatic lathe that had been idle a large share of the time over a period of several years was brought up as a subject for discussion. The opinion of the foreman in charge of the department was that the machine was not a producer on small quantities of work, due to the fact that it took as long to set the job up properly as would be required to complete the work on an ordinary engine lathe. A committee was appointed to make an investigation, and they found that by using a few special mandrels and some other tools, the machine could be so quickly set up for certain jobs that even small quantities could be machined at a saving over the engine lathe time.

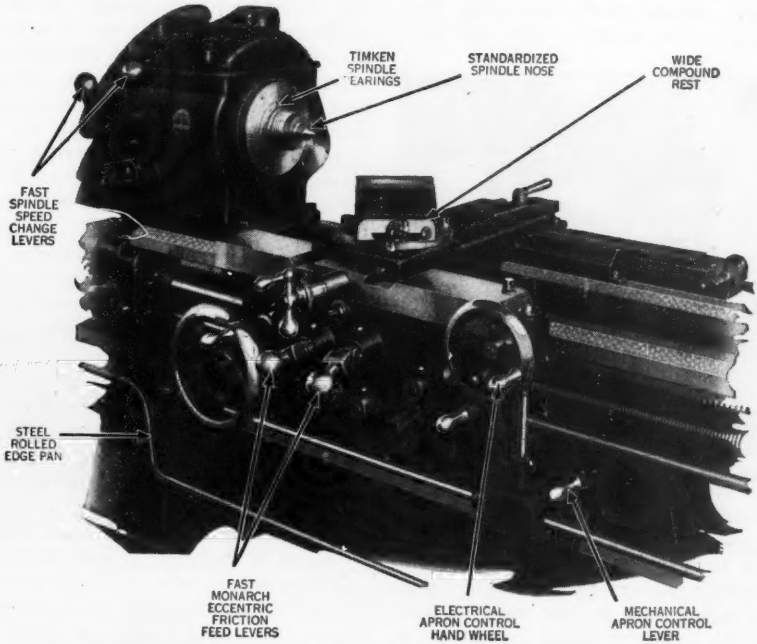
One of the troubles found with the machine was the difficulty of placing





(Left)—This Hisey-Wolf grinder replaced an old-fashioned swing grinder. (Below)—This semi-automatic lathe can now be used profitably on small quantities.

Here Are 8 Reasons Why Monarch Timkenized Lathes Should Be Your Choice


TIMKEN SPINDLE BEARINGS
STANDARDIZED SPINDLE NOSE
WIDE COMPOUND REST
FAST SPINDLE SPEED CHANGE LEVERS
STEEL ROLLED EDGE PAN
FAST MONARCH ECCENTRIC FRICTION FEED LEVERS
ELECTRICAL APRON CONTROL HAND WHEEL
MECHANICAL APRON CONTROL LEVER

WRITE FOR FACTS AND FIGURES

Learn why most of the Timkenized lathes now being produced are Monarchs. Learn why Monarchs are the choice of 181 Railway Repair Shops. Learn why Monarchs enable the operator to do a bigger day's work with less fatigue. Learn why Monarchs are ***smoother, quieter, more powerful.***

THE MONARCH MACHINE TOOL CO., Sidney, Ohio

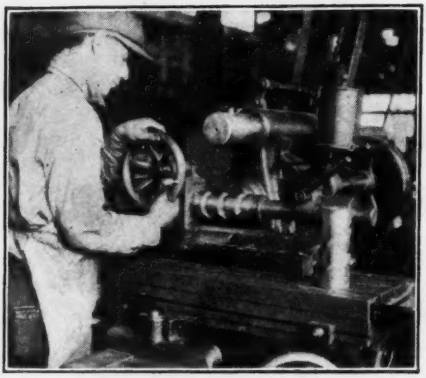
New York Office: 857 Graybar Bldg.

Monarch lathes

Helical Gears - Timken Bearings

SMOOTHER..QUIETER..MORE POWERFUL

work on the mandrel in a given position in relation to the tool. To remedy this condition, a key was put in the mandrel and a collar was put on which served too locate the work at a given point each time. This, of course, necessitated changing the routing of the work so that the key-



Leaving this old miller set up for one job has made it a paying proposition.

way would be cut in the piece before it was turned.

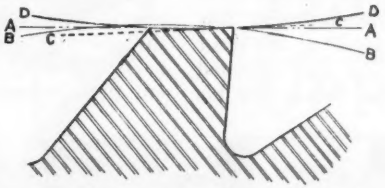
Another subject was a milling machine which was so out of date that it would not lend itself to use on a variety of work. The discussion centered for a time on the advisability of selling it as a second-hand machine. The sale was attempted, but the amounts bid were hardly more than the machine would have brought as scrap iron. The consensus of opinion among the members was that the machine should not be sold at any of the prices named. This being the verdict, a place had to be found for the machine that would warrant giving it floor space and putting it into commission. A committee was named to investigate the possibilities of selecting, for machining, one certain part which was produced in large quantities and for which it would pay to set the machine up and leave it set up continuously. The part decided upon was a cylindrical cam with a double-throw feature—rather a difficult job to set up and one upon which the cutter was required to be operated above the normal rate of speed. After the machine was set up, it was found that the time on this job was reduced considerably. Considering that production could be started at any time on the machine without having to lose time in setting up, the saving made showed a very fair return on a fair estimate of the value of the equipment, including the overhead.

These are a few of the results that have been accomplished by a foremen's organization that meets for the purpose of actually accomplishing something. Neither membership nor attendance are compulsory, although every executive and department head in the plant belongs to the club, and every one attends the meetings, too, unless something important keeps him away.

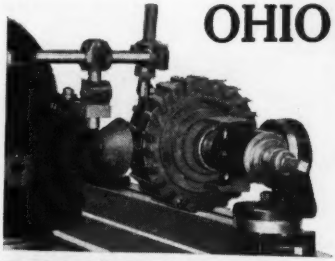
One of the most important considerations is that these men are training themselves into the habit of looking at themselves and their problems from the same angle as they are looked at by the owners of the equipment. They are getting themselves into the habit of considering their work from an engineering standpoint, rather than as a simple job of bossing the production of work by cut-and-dried operations. Conducted along such lines, a foremen's organization is productive of good results and would be an asset in any plant where there are a number of departments.

For cutting threads on tool steel, the best lubricant is a mixture of two-thirds common lard (not lard oil) and one-third turpentine. Apply with a small brush.

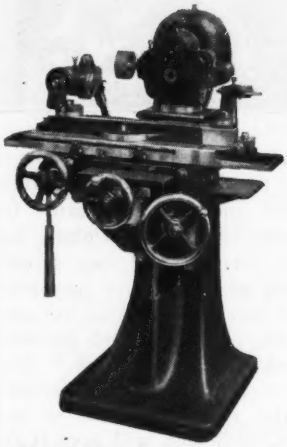
Cutting tools last longer—cut better—when properly ground



DD represents periphery of grinding wheel, BB circumference of cutter, AA desired clearance as obtained with cup wheel on Ohio Grinder, CC clearance angle obtained using periphery of grinding wheel for clearance.



Sharpening the Periphery of an Inserted Tooth Face Mill.



No. 2 Ohio Universal and Tool Grinder, Motor Driven, Forced Feed Table Lubrication.

OHIO Grinders preserve cutter life by correct grinding

MANY cutters pass their stage of usefulness prematurely due to incorrect grinding, but proper grinding costs no more than any other.

Ohio Grinders produce a solid backed cutting edge that has double the life of any hollow one.

The added life given to cutters is actually a saving in cutter investment. These small savings mount rapidly and soon pay for your machine.

It's just as easy to make your tools do more work for less cost, even though the initial investment may be a trifle more.

The sketch above shows the difference between right and wrong grinding of face mills. The illustration at the left, correct set-up on an Ohio Grinder.

You can get a complete story on tool grinding from our booklet "E." Write for your copy today.

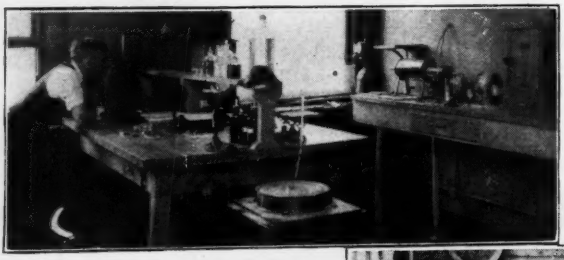
The Oesterlein Machine Co.

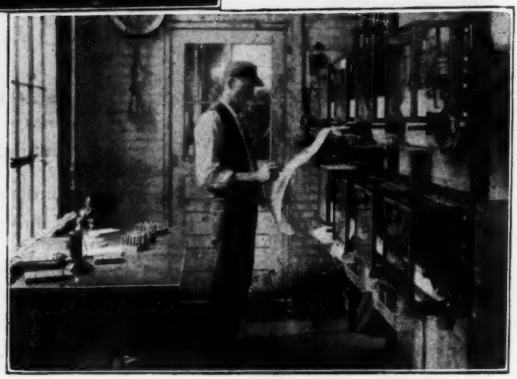
3319 Colerain Ave., Cincinnati, Ohio, U. S. A.

The Heat Treatment of Steel Parts

By A. S. Irvine*

HOW many of us have, in our "barefoot days, stood at the door of the blacksmith shop and watched the smith pumping the bellows of his forge, and then have seen him pull a red-hot piece of steel from the fire and plunge it into a cask of water. This operation, the smith knew, hardened the steel and gave it certain wear-resisting qualities.



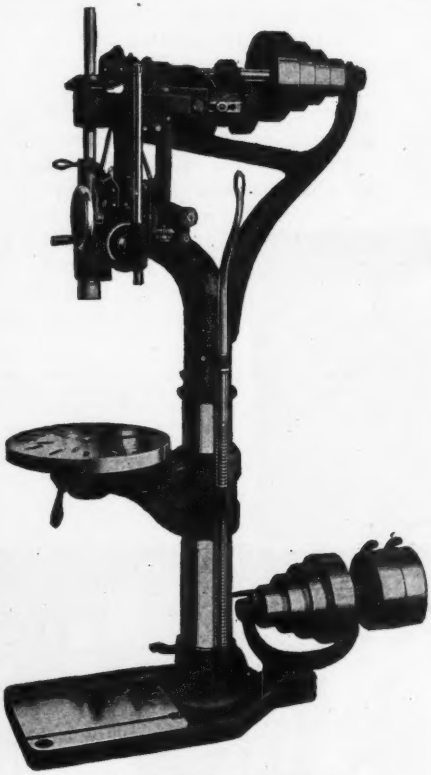


(Left)—A corner in the laboratory. Samples from each lot of incoming materials are analyzed here, and heat-treated parts are tested to make sure that they are receiving the correct treatment. (Below)—The temperature of each furnace is controlled and recorded by one of these pyrometers. Any fluctuation in temperature is instantly registered.

But his method of heat-treating steel is as obsolete as the smith, himself, is today. The development of the automobile and allied industries created a demand for new standards of precision in the qualities of the metals used, with the result that the science of heat-treating has finally progressed to a stage where the temperatures of the furnaces are automatically controlled within a few degrees, thus insuring the production of parts of uniform structure.

Among the firms who are keeping pace with the times in the science of the selection, uses, and treatments of steel is the Ross Gear & Tool Company. This firm has been engaged in the manufacture of gears and similar parts for many years and at the present time is concentrating on the production of steering gears. Steering gear parts to which heat treatments are applied include the cam (or worm), lever shaft, thrust plate, ball races, lock sleeves, and cap screws. The steering gear is a very important part of the mechanism of an automobile, and must be prepared to withstand shock when necessary. Consequently each part in the assembly is given the treatment that is best suited to it, or which will give it the necessary qualities to enable it to perform its task without failure.

* Metallurgist, Ross Gear & Tool Co.



Barnes 20-inch Drill with Power Feed and Automatic Stop.

Barnes

UPRIGHT

Drills

With Stationary Head—
15, 20, 22½, 25-inch swing.

—

With Sliding Head—
22, 26, 28, 34, 42, 50-inch swing.

—

Gang Drills—
20 to 26-inch swing.

Barnes Upright Drills are made in a range of sizes from the 50-inch swing, required in the railroad shop, to the 15 and 20-inch sizes used in the small machine repair shop and garage service.

Arranged for Silent Chain or Belted Motor Drive. With or without Power Feed.

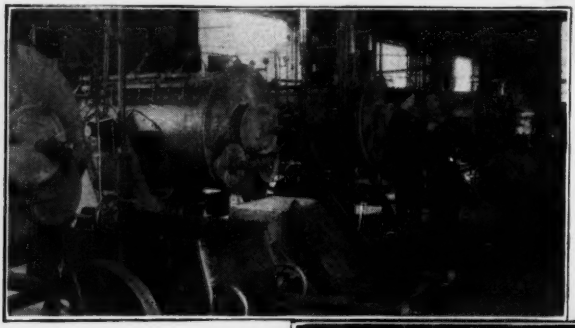
Write for Our Circulars Giving Complete Information

W. F. and JOHN BARNES CO.

ROCKFORD, ILLINOIS

Upright Drills Screw Presses
Horizontal and Vertical Production Drilling and Boring Machines

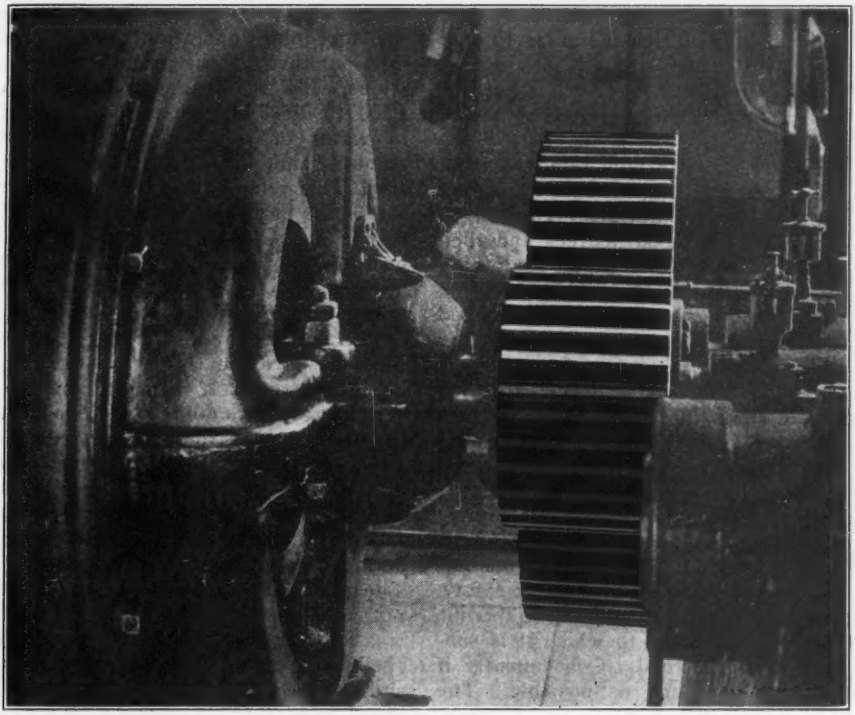
The heat-treating equipment in this plant consists of a battery of six gas-fired furnaces for use in carburizing the steel, and seven electric and gas heated furnaces for drawing and tempering, together with the necessary pyrometers, quenching tanks, and so on. As it is essential that the oil in the quenching baths be maintained at a constant temperature, the oil is circulated through a water-cooled tank in which the temperature is thermostatically controlled. The pyrometer equipment is located in a separate room.



(Left) — These six gas furnaces are used for carburizing. (Below)—The steel parts are reheated or "drawn" in these electric furnaces, and are tempered or hardened by dipping in oil or water in the tanks shown at the right.

All heat-treating operations are controlled from the laboratory, where samples of incoming materials are tested to make sure that they meet specifications, and where treated parts are checked at frequent intervals to make sure that nothing unusual is happening in the processes. The practice of analyzing incoming shipments of steel was inaugurated about eighteen months ago, and at that time the rejections of material that failed to meet specifications amounted to three or four per month. Any lack of the necessary qualities in steel that is to be used in steering gears is a serious matter. At the present time, thanks to the laboratory, the sources of supply are meeting the specifications so successfully that rejections do not exceed one in three or four months. But the checking and testing goes on, to insure a standard product.

Probably the most important part of the steering mechanism is the worm, which must be prepared to resist both wear and shock. The material used is soft steel, and to enable the worm to perform its task successfully, it is given a treatment that gives it a hard surface while at the same time making the core tough and difficult to break. To obtain this result the parts are packed in carbonaceous materials and placed in the gas furnace, where they are heated to a temperature of 1,675 to 1,700 degrees. They remain in the furnace for something like seven hours, total time. This treatment causes the carbon from the packing material and from the gases generated to penetrate each



Quiet Gears for Big Drives and Little

Formica combines silence with unusual elasticity and resistance to fumes, chemicals and other difficult conditions.

Production managers value the silence that saves the nerves of their men and increases production and tends to prevent spoilage. They also value the elasticity in the drive that saves their machines.

The Sales Departments know how much these qualities help to sell machinery. More Formica gears are used every month.

THE FORMICA INSULATION CO.

4632 Spring Grove Avenue CINCINNATI, OHIO

FORMICA

piece to a depth of approximately 1-32 inch, making the case similar to tool steel in composition, but coarse grained and soft. The core is left soft and ductile. They are then cooled slowly.

The worms are now removed from the boxes and piled in the hardening furnace, where they are reheated to approximately 1,550 degrees and then quenched while hot. Steels containing 3½ per cent nickel are quenched in oil, the ordinary steels being quenched in water. This treatment refines the core, making the grain fine and exceedingly tough. The pieces are then heated again to 1,400 to 1,425 degrees and quenched as before, which makes the surface glass-hard, able to resist wear, and at the same time refines its grain, giving the case considerable toughness without affecting the core.

The steering arm is of prime importance from a standpoint of safety, and must be able to resist the terriffic strains and shocks to which it is subjected on the road. Consequently it must be as tough as possible. The material used for this part is a medium carbon steel, containing from .25 per cent to .45 per cent of carbon. Alloys are frequently used on the heavier jobs.

It should be remembered that the operations which impart hardness and toughness are opposed to each other, and as a heat treament adds one quality, it subtracts from the other. For a part that is subject to both wear and strain, the ideal treatment is one which will harden the piece sufficiently to resist wear, at the same time producing the smallest grain size, together with the greatest possible amount of toughness.

The arms are first given a "normalizing" treatment, which consists of heating them to 1,500 to 1,600 degrees temperature and then cooling them with air. This treatment relieves any strains that may have been set up in the foregoing operation. They are then put through the machining operations, after which they are heated to 1,500 to 1,525 degrees and quenched in water or oil, depending on the amount and kind of alloys in the steel. This refines the grain but leaves the pieces hard and brittle. The final operation is that of "drawing" or reheating the parts to 1,000 to 1,100 degrees, which makes them tough and minimizes the brittleness.

The lock sleeve is a part which must be hard, but is not required to be shock-proof. It is made of a low carbon steel, containing .10 per cent to .20 per cent carbon. The sleeve is given a simple treatment, consisting of packing quantities of 50 or so in molten sodium cyanide and heating them to 1,500 to 1,525 degrees for a period of approximately ten minutes. The parts are then lifted out of the pot and quenched in water. This treatment gives the sleeve a hard shell to a depth of .003 to .004 inch, and at the same time toughens the metal underneath the case.

The cap screws used in the cover plate, while not in position to be subjected to strain, must be tough and hard enough to prevent the threads from stripping. The material is steel with a carbon content of .25 per cent to .35 per cent, which is about the same as ordinary cold drawn bar stock. The screws are heated, without packing, to approximately 1,550 degrees and are then quenched in oil, which refines the grain of the steel but hardens it to the point of brittleness. They are then "drawn"—or reheated—to a temperature of 900 to 1,000 degrees and quenched in oil again. The drawing heat changes the brittleness to toughness, which is the desired result.

The temperature of each furnace is

(Continued on page 58)

Bradford "ALL GEARED"

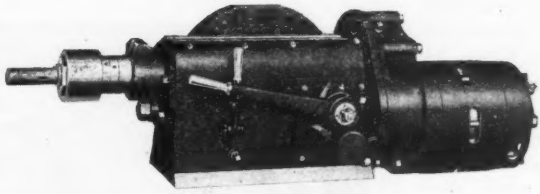
(PATENTED)

Original Low Drive Lathes

BRADFORD "All Geared" Lathes have tremendous power, yet are practically vibrationless even when pushed to the limit. Tooth and chatter marks are absent. Every strain tendency in the head is downward, drive is from beneath, tool thrust locks head tighter to bed. LOW COST of upkeep and no tie-up for repairs—1,200 this type in use and no repairs. Forced feed lubrication, which distributes a measured quantity of FRESH oil to 33 surfaces, can be furnished. Sizes 14″ to 48″ inclusive.

Bradford Unit Type Drill Heads
Unit Type Tapping Heads

(PATENTS PENDING)



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"Offset" Milling

By GORDON KEITH

WITH the idea of engaging as much of the cutter as possible in the work at one time and thus producing the maximum in results, the Oesterlein Machine Tool Company has developed a milling machine in which a vertical arbor is used and the machine is practically built around the arbor, the arrangement being such that more than 50 per cent of the teeth are in active operation continously. The principle upon which the machine is designed is called the "offset" principle, due to the fact that a circular table is used and the center of the cutter is offset from the center of the table so that the teeth, at the point of greatest depth, will cover the surface to be finished.

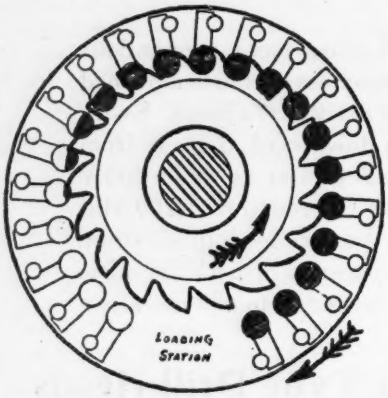


Fig. 1—In "offset" milling, more than half the teeth are engaged simultanteously.

The "offset" principle is illustrated in Fig. 1, which shows the method of engaging the work with the cutter. The table and cutter revolve in opposite directions and the cutter is offset enough so that the entire face of the piece will be covered by the cutter at one side of the table. The other, or front side of the table, is used as a loading station. The production is equal to the number of pieces that the table will hold, times the number of table revolutions per hour. The piece indicated in Fig. 1 is produced at the rate of 2,400 per hour, or a table load of twenty-four pieces times a table speed of 100 revolutions per hour. Such a speed is possible because of the fact that so many cutter teeth are engaged in the cut at a time, the cut thus being distributed so that

Fig. 2—Top view of Ohio Tilted Offset Miller, showing steering spindles in position for milling.

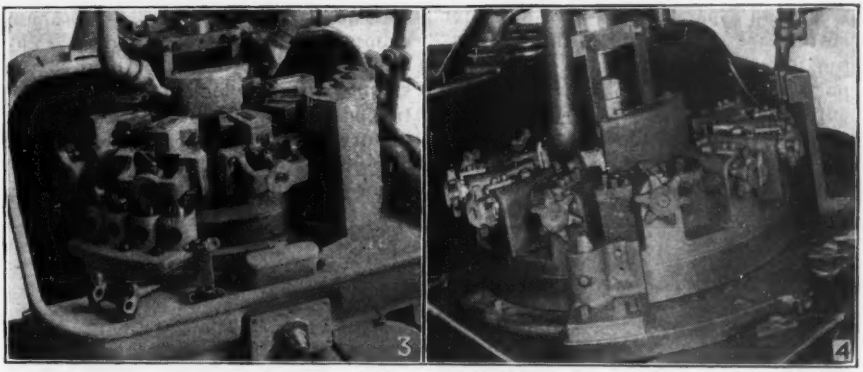


Fig. 3—Side view of steering spindle job, showing operation of clamping device.
Fig. 4—Straddle-milling shock absorber wings. 12,000 parts are milled per grind of cutters.

the load on each tooth will be relatively lighter, allowing the speed to be increased accordingly.

A top view of an Ohio Tilted Offset Miller is shown in Fig. 2, showing the relation of the cutter to the work. The part in process is a steering spindle and the fixture is made to hold eight pieces. The outboard bearing and guard have been removed so that the cutters can be seen. There are four cutters in the gang, the two outside cutters being 11 inches and 10½ inches diameter and the inside cutters being 10 inches diameter, all held on a 2¾-inch arbor. The cutters are driven by two ¾-inch keys that are set on quarters, and the arbor is steadied by a 2⅛-inch diameter pilot on the lower end.

Each spindle is locked in the fixture by a clamp that is operated by a star-wheel which is automatically revolved by the clamping arrangement. All that the operator does is to put the piece of work in the fixture; as each piece passes the clamping mechanism, one point of the star-wheel is caught by a pin which turns the wheel and clamps the piece. As the piece reaches the opposite side of the table, after the machining process has been completed, a similar device turns the star-wheel in the opposite direction and releases it. The table revolves at a speed of 25 revolutions per hour, thus producing 200 pieces.

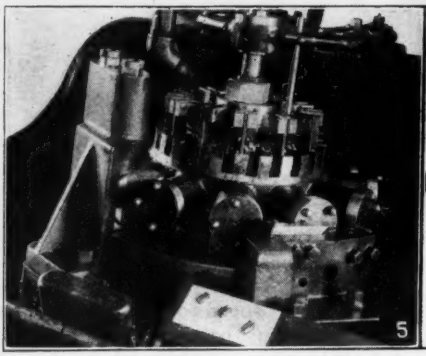
A side view of this job, giving a better view of the automatic clamping device, is shown in Fig. 3. There are four pins set in a row, each of which gives the star-wheel a turn as it passes. In order to prevent the possibility of damage in case the wheel becomes locked before the last pin is reached, each pin is set on a strong spring which holds the pin in position until pressure against it becomes strong enough to force it down in its guide to a point that will allow the star-wheel to pass.

In this illustration the coolant pipes are shown in position, also the guard which is located between the cutters and the work at the front, or loading position. Two of the pieces of work are shown on the machine-table.

A machine with a 12-unit fixture for straddle-milling shock absorber wings is shown in Fig. 4. With the table running at a speed of 62.5 revolutions per hour, a production of 750 pieces per hour is maintained. The parts are small, of a good grade of drop-forged

steel, and a pair of 13½-inch diameter cutters are used. One of the interesting features of this job is that 12,000 parts are produced per grind of the cutters.

Another high-production job, shown in Fig. 5, is that of milling slots in links for gas-pumps, for which a sin-



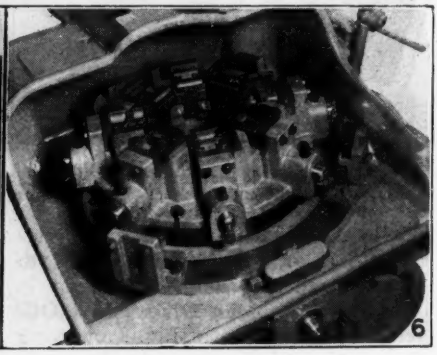


Fig. 5—2,200 links per hour are slotted in this fixture. They are clamped, released, and ejected by air. All the operator has to do is to place them in position.
Fig. 6—Here is the old familiar bearing cap job in a new setting. A production of 420 caps per hour is obtained with this method.

gle 10-inch cutter is used. As the part is small and made of cold drawn steel, a production of 2,200 pieces per hour is obtained. The pieces are clamped and unclamped by the automatic clamping device, and as each one in turn is released by the clamp, it is automatically ejected by a blast of air which also blows out the dirt and chips. Thus all the operator has to do is to put the pieces in position in the fixture; the rest of the operation is entirely automatic. The fixture used for this job is of slightly different design than those previously shown, but is built upon the same principle.

The operation of milling bearing caps, which has been performed in so many different ways, is also handled to advantage by the offset process. A fixture that is made to hold eight caps is shown in Fig. 6. The pieces are automatically clamped and unclamped, each piece being held by movable jaws that are held by a strong spring, which, in turn, is controlled by a plunger. As each piece in turn passes the locking device, the plunger is pushed in far enough to allow a latch on the plunger to drop into place, thus holding the plunger in place and, by the pressure of the spring, holding the piece of work between the jaws of the fixture. After the milling operation is completed, the jaws are released by a similar device, except that when the plunger is pushed in, a cam raises the latch and allows the plunger to back out, releasing the spring and the work. A production of 420 pieces per hour is obtained on this operation.

Never mount a grinding wheel without some compressible substance between the wheel and the flange, such as rubber or blotting paper. Never force a grinding wheel onto the shaft or spindle; see that it slides on easily. Before mounting, tap the wheel lightly with a hammer so as to make sure, from the tone of the ring, that it is not cracked.

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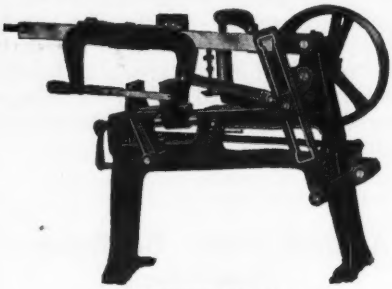

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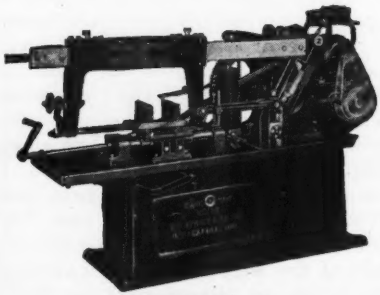

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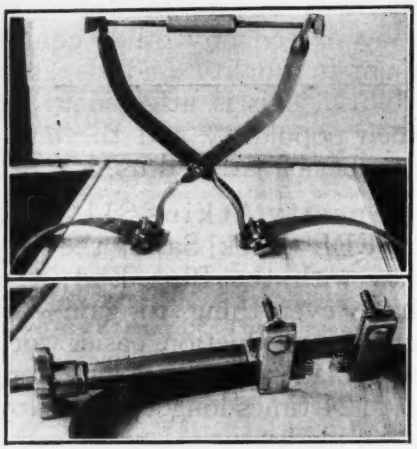
Ideas From Readers

This department is a clearing-house for ideas. If there are any "kinks" or short-cuts in use in your shop, send in a description of it. We will pay $5 for each one published.

Two Useful Belt-Lacing Tools

By Douglas Howard

The superintendent of a plant building large, heavy machinery in which some of the belts that operate accessory parts are located in tight places has developed the tools shown to aid in putting the belts on the pulleys. The tool shown in the upper illustration is used to put belts on flanged pulleys, the ends of the belt being clamped in the tool as shown and then drawn together by turning the screw. One end of the screw carries a right-hand and the other end a left-hand thread, so that the two arms of the tool are forced apart as the screw is turned and the ends of the belt are drawn together. This tool is used on a 3½-inch belt.



Tools used to lace belts after they have been placed in position around the pulleys.

The lower tool is used for putting the belt on a pump which is located in such close quarters that there is no room to pass the belt by the pulley. The belt is put around the pulleys and the ends are clamped in the tool as shown. One of the clamps is stationary on the end of a ⅜-inch shaft, the other clamp being attached to a section through which the shaft passes. The opposite end of the shaft is threaded for a star-wheel handle which, when turned, forces the clamps together so that the pin can be slipped into the lacings.

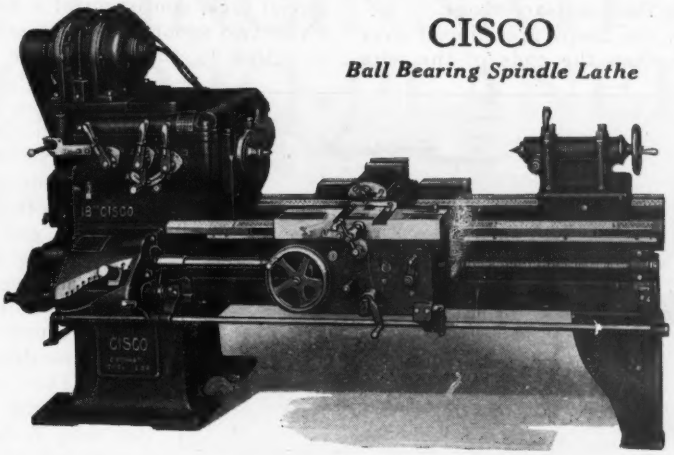
A Home-Made—But Better—Hose-Clamp

By B. E. Clement

Having had a great deal of trouble with hose-clamps breaking—usually at a most inconvenient time—we turned to the use of wire, and finally developed a simple clamp of our own. In order to make and use the clamps efficiently, we had to make the tools shown in the illustration. The clamp consists of a 15-inch length of No. 11 iron wire. This wire is first bent around the bosses on the tool "A," then the loops are bent parallel, the ends of the wire are inserted through two holes, as shown, and the lever-handles are brought as close together

CISCO

Ball Bearing Spindle Lathe



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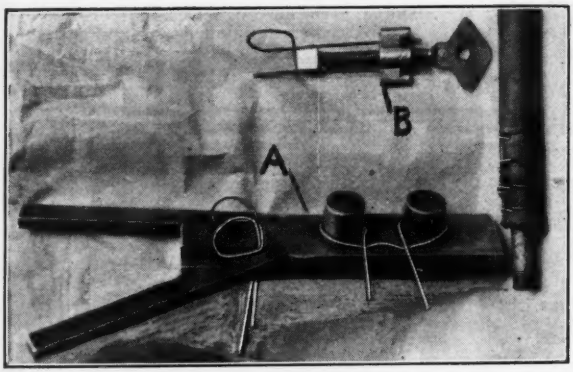
as they will come. This action gives the clamp the necessary shape.

In use, the loops are slipped over the hose, then the ends of the wire



Tools for making wire hose clamps.

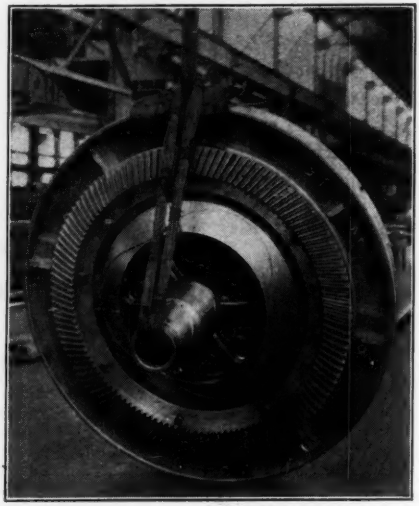
are slipped through two holes in the tool "B," where they are fastened with two thumb screws. By turning the main screw, the wire is pulled tight around the hose, then it is bent over to clinch, and the ends are cut off. One of these clamps will outwear several of the ordinary type and is much cheaper.

A Safe Crane Sling

By JOHN BYRUM

UNDOUBTEDLY many injuries to both workmen and property have been caused by the breaking of a rope or chain sling by which some heavy object was suspended from a traveling crane hook. One large machinery plant uses a sling made of a number of small strands of rope bound together, which has the advantage in that if it breaks, as all rope slings will, ultimately, only one strand parts at a time and the crane operator has time to lower his load in a safe place before the last strands have snapped.

The sling is made by the use of a special rack, consisting of a frame on which two spools are hung and which is bolted to the wall. One of the spools is attached to a section that can be adjusted horizontally by a feed screw. The sling is made up of ⅜-inch or ½-inch hemp rope, the end of the rope being brought down and secured in one of the holes bored in the center of the lower crossbar of the rack. The rope is then wound around the sling reels, going from left to right when the spool of rope is to the left of the sling rack. The reason for winding the sling in this manner is to



Hoisting an 8-Foot Machine Table with a Sling of ⅜-Inch Rope.

keep it from buckling when thrown on the floor.

After the rope has been wound on

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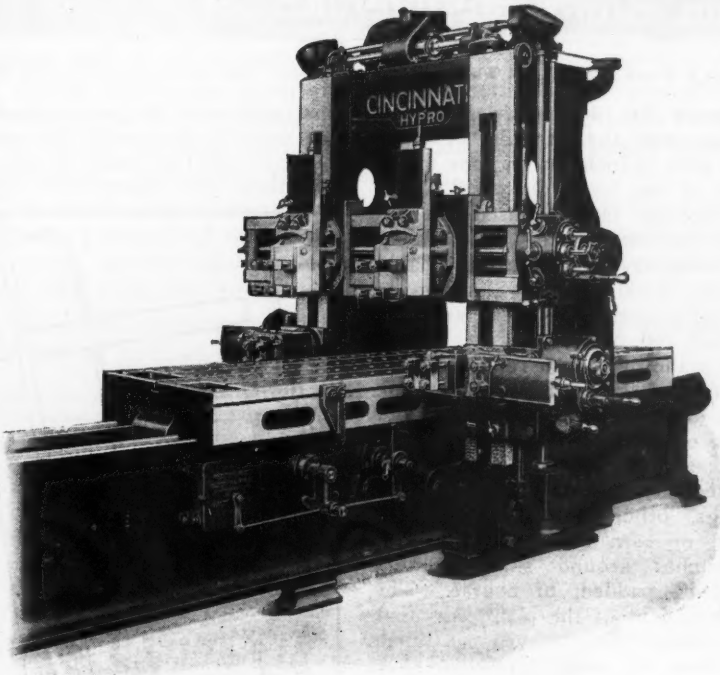

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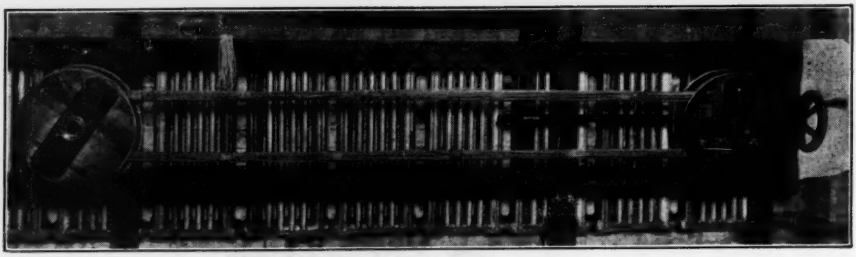


The Rope is Wound Around These Wheels. Then it is Stretched Taut and Bound at Two-Foot Intervals.

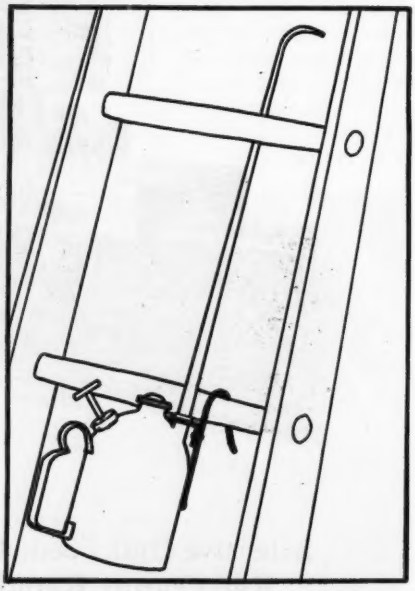
the spools the two ends are spliced together and the strands of rope bound with ⅛-inch cotton rope at intervals of two feet. On small slings wire bindings may be used. A 34-strand sling made up of ⅜-inch hemp rope, when new, is said to be capable of lifting 35,000 pounds. Slings made of ⅜-inch rope, when new, are said to stand 700 pounds to the strand. Those made of ¼-inch rope are good for around 500 pounds to the strand.

One of these slings will last about 50 per cent longer, if care is taken when making the hitch. Make sure that the loop drops down past the bindings, otherwise they might be broken or torn off during the lift. All hitches around sharp corners should be padded, of course. The superintendent of the plant says that these slings have proved so much safer than the usual type that they would think of using no other.

Handy Oiler's Can

By H. V. Miller

How many times has the oiler in your shop dropped an oil can from some high vantage, smashing the spout and rendering a good oil can useless? In one shop the writer visited recently it is the practice to place on each new can a small holding bracket, as shown. Result: hardly an oil can ever sees the junk pile until it is worn out. The illustration tells its own story and it is a very simple matter for any mechanic to take two pieces of strap iron, bend them into shape, rivet together,



bore a hole for the spout cap to go through when screwed into the can, and solder the lower end of the bracket hook on to the can.

The best belt dressing is made of equal parts of neatsfoot oil and tallow, melted together. This dressing will preserve the leather and will keep the belt soft and pliable.

In the July issue of MODERN MACHINE SHOP

an unusually well-laid-out jobbing and manufacturing shop will be described and illustrated.

¶ "Kinks from the Monon Shops" will contain descriptions and illustrations of a number of unusual tools and machines which will be of interest to every Railway Shop Executive.

¶ Turret lathes are great producers when handled properly. "Making the Turret Lathe Produce" will describe—and show—a number of tools and set-ups which have "brought home the bacon" with these machines.

¶ In addition to these there will be several other articles that will be interesting to all machine shop superintendents and foremen, written with the idea that they must be of practical use, and well illustrated.

¶ Make this magazine your handbook; keep this copy and add the others to it as they come in each month.

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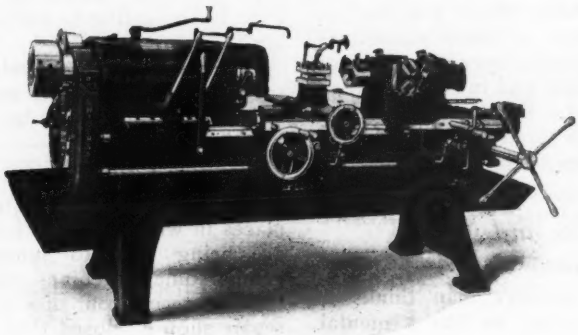

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MODERN Machine Shop

HOWARD CAMPBELL - - *Editor*

A Word of Appreciation

To the manufacturers who have expressed their approval of our policies and their confidence in our ability to successfully carry on the task we have set for ourselves, and who have given evidence of that confidence by material support, we wish to express our appreciation.

Time passes, conditions change, the world progresses—and those who are found keeping pace with the new order of things are those who are young enough in mind and spirit to recognize the value of the new and to make themselves a part of it.

The manufacturers who have supported the initial issue of MODERN MACHINE SHOP have made themselves a part of it; their co-operation has helped to make it possible for us to furnish technical information regarding machine shop practice to many thousands of shop executives who have hitherto been deprived of such information, and in so doing they have evidenced a spirit of service and progress which should commend them to every reader of this magazine.

New Markets and New Opportunities

When the average man thinks of mines and mining, he has a mental vision of a man with an oil-lamp on his cap and pick and shovel in his hands. Those who are not familiar with modern mining operations will be interested to learn that the development of machinery for mining coal has successfully passed the experimental stage, and that the mechanizing of the coal mining industry is progressing with increasing speed.

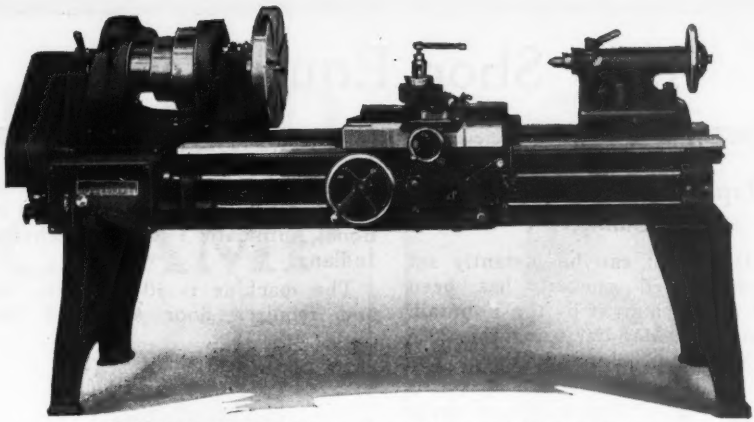
Mines in which experimental machines were installed are now being mechanized completely. Mining machines produce many times more than can be produced by hand labor with the same number of operators, the work requires training which eliminates the drudgery of the job and makes it more interesting, and the possibility of accidents is considerably reduced. One firm has twenty-six mines operating that are 100 per cent mechanical and there are many more in which machinery has entirely replaced hand operations.

Machinery for mining must be kept in repair, consequently as mines "go mechanical," adequate machinery must be installed for maintenance purposes. The United States Bureau of Mines reports that "young men who have mechanical ability are realizing that there are good opportunities for them in mechanized mines as operators and mechanics." The Bureau also reports that "accidents have been reduced 50 per cent since the change was made from hand loading to mechanical loading."

Progress in the coal mining industry is opening markets and opportunities which should not be overlooked.

Portable Tools

It is interesting to note the many places in which modern portable tools are being used to supersede more cumbersome machines of an older type. A recent tour of a large railway repair shop disclosed that, in addition to the uses to which portable tools are usually put, a number of such tools had been anchored permanently in place and were giving more efficient service than the antique contraptions which they had replaced.



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"Rapid" Quick-Adjustable Clamp

A clamp that can be instantly set to any desired opening has been placed on the market by the Fountain Equipment & Manufacturing Co., 2025 Elm Street, Cincinnati, Ohio. The clamp is made of the best grade of drop-forged steel, and is designed to afford the greatest rigidity when in use.

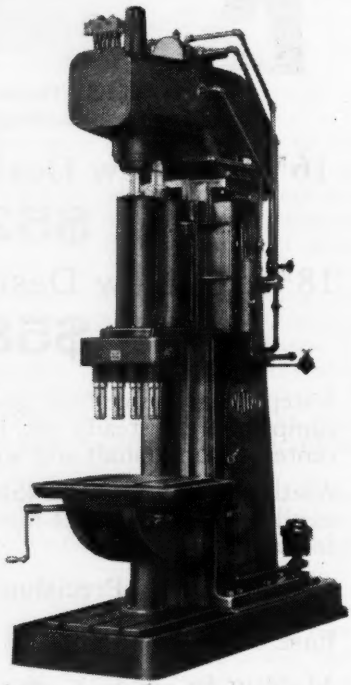
"Rapid" Quick-Adjustable Clamp

The feature of the clamp is the manner in which it is adjusted to the work. Instead of the usual screw, a ram is provided which slides in a sleeve, and which can be instantly adjusted to the work. It is held in position by a rachet and pawl, the pawl being controlled by a trigger. The final adjustment is made and the necessary amount of pressure is obtained by means of a screw operating through the ram. Every part of the tool is designed for extra heavy duty and long service, and the tool is warranted to be free from defects in material or workmanship.

Natco Single Spindle Hydraulic Driller

A vertical-type hydraulic drilling machine with a single spindle, designed for the application of drill heads, has been developed by the National Automatic Tool Co., Richmond, Indiana.

The machine is 10 ft. 11 in. high and requires floor space of 34x85 inches. It has one vertical sliding head which contains one No. 5 Morse taper spindle, both this spindle and the rest of the machine being equipped with ball bearings. The maximum distance from the end of the spindle to



Natco Model B-250-H Single Spindle Hydraulic Driller

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RAPID

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CLAMP

No more time wasted turning the screw. Pull the trigger, set the ram up to the work, then give the screw two or three turns to obtain the necessary pressure,

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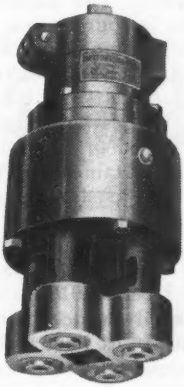

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The United States Drill Head Co.

1954 Riverside Drive

Cincinnati, O., U. S. A.

the table is 38 inches. The table can be raised 17¼ inches, and the spindle feed 20 inches. The diameter of the spindle nose is four inches. The spindle is built to stand a thrust of 6,635 pounds. The hydraulic cylinder is 6½ inches in diameter.

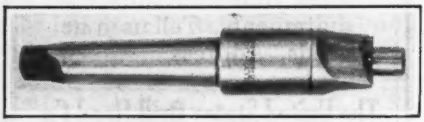
The driving gear is intended to operate at a speed of 315 r.p.m. Speed changes are obtained by the use of pick-off gears, speeds of from 93 r.p.m to 329 r.p.m. being possible. Feeds up to 15 in. per min. are provided for, giving the machine a capacity of 2½ in. in solid steel at .010 in. feed.

The finished surface of the table is 20x26 inches. A 1,200 r.p.m 10 h.p constant speed motor is required for general manufacturing purposes. With a plain table, the net weight of the machine is 8,000 pounds.

Scully-Jones Counterbore

Another application of their principle, "center by the shank and drive by the square," is shown in the accompanying illustration of a counterbore that has been placed on the market by Scully-Jones & Co., 1901 S. Rockwell Street, Chicago, Ill. The tool is designed so that the drive will be at the nearest point to the cutting edge, which is intended to provide for long life and a large production per grind of the cutter.

The counterbore will be furnished with either standard Morse Tapers or with a special shank, as desired. The driver is made from a select grade of



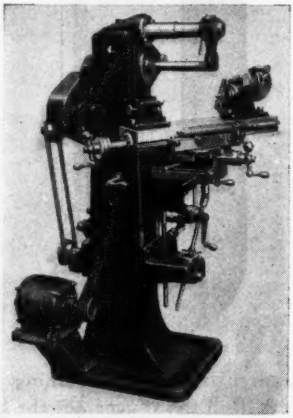
Scully-Jones Counterbore

steel of high tensile strength, hardened and ground, the shanks being heat-treated to obtain a maximum of toughness. Pilots are hardened and ground, with soft, tough steel shanks. The tool is ground on centers.

When using the tool for spotfacing, the driver is furnished with a spring ring for holding the cutter. To remove the cutter, it is only necessary to insert a small screwdriver in the slot and apply a slight pressure, which releases the blade.

"Artisan" Universal Milling Machine

A milling machine of comparatively light design, but remarkably rigid and extremely accurate, has been placed on the market by The Artisan Manufacturing Co., 879 Hathaway Street, Cincinnati, Ohio. The machine is particularly adapted to the exacting requirements of the tool-maker, vocational instructor, or experimenter, as well as the manufacturer.



"Artisan" Universal Milling Machine

The machine is 60 inches high and occupies floor space of 50x36 inches. The over-all dimensions of the table are 23x6 inches, with a working surface 19x6 inches. The table will swivel

Better, faster, cheaper drilling with "Buffalo"

"Buffalo" 21-inch, back-geaerd upright drill, pulley driven

"Buffalo" 21-inch back-geared upright drill is a big, powerful, well-balanced machine, having eight speeds, three power feeds and hand and ratchet lever feeds.

The spindle has an unusually long travel of 12½ inches.

The arrangements of this drill make it possible to change instantly from plain to back geared drive, by only disengaging a knurled knob in the top gear and throwing in back gears by means of a hand lever.

All bearings are slit and adjustable for wear.

A dependable accurate drill for every machine shop, at a moderate price.

Bulletin and price gladly sent on request

Buffalo Forge Company

446 Broadway Buffalo, N. Y.

In Canada—Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

45 degrees right or left. Using power, a longitudinal feed of 14 inches and a cross feed of 5 inches can be obtained. The table is raised and lowered by hand, a maximum adjustment of 11 inches being obtainable. The maximum dimension from the center of the spindle to the table is 11 inches, and from the face of the column to the arbor support is 10 inches. From the center of the spindle to the under side of the overarm is 4 inches.

Power is applied through a belt which runs on three-step cone pulleys. When motor-driven, a ½-h.p. 1,725 r.p.m. motor is recommended. The counter shaft is self-contained, with friction clutch and brake. The spindle carries a No. 9 B. & S. taper hole, and the nose is 2⅛ in. dia., with an 8 P. U.S.S. thread. Six different speeds are obtainable, from 21½ r.p.m. to 500 r.p.m., and feeds from .00075 to .024 inch can be obtained.

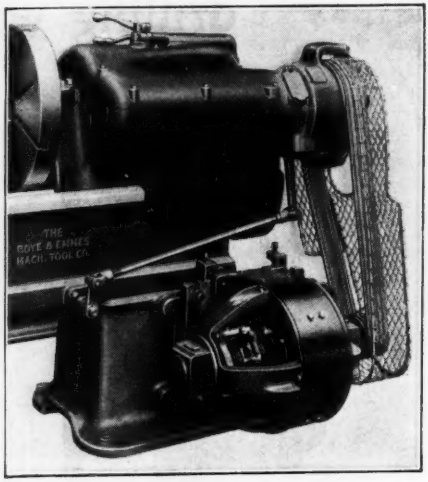
Each machine is regularly supplied with countershaft, arbor support, ⅞ or 1 inch arbor complete with collars, draw-bar, micrometer feed-dials, table-stops, oil pot, belts and necessary wrenches. Weight of machine, 650 lbs.

Texrope Drive For Boye & Emmes Lathes

All sizes of Boye & Emmes lathes can now be equipped, at no extra charge, with the Texrope Drive instead of geared motor drive or motor drive through the flat belt. The illustration shows the Texrope Drive applied to a 20-inch lathe, but is typical of the arrangement for all sizes as built by this company.

The motor is mounted on a planed pad at the rear of the pedestal, and is supplied with a vertical adjustment to secure the proper tension of the belts. The drive is designed to utilize a motor of not more than 900 r. p. m. A wire mesh guard protects the pulleys and belts.

Some of the advantages claimed for the Texrope Drive are the elimination of the idler pulley used in flat belt



Texrope Drive for Boye & Emmes Lathes

drive, a smoother drive due to the belts being endless and of a more flexible nature, the practical elimination of stretch and slip, absence of vibration, efficient operation on short centers, and easy and cheap replacement when the belts are worn out.

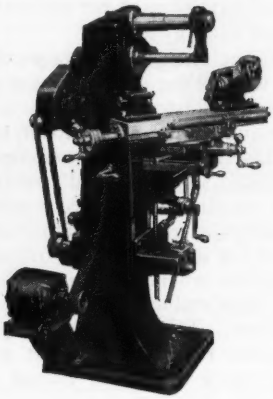
Hisey Sensitive Radial Drilling Arm

The illustration herewith shows the Hisey Double Radial Arm, which has been designed by the Hisey-Wolf Machine Co., Cincinnati, O., for use with Hisey portable electric drills. The arm can be furnished for drills up to and including ⅞-inch capacity. The motor-holding brackets are designed so that the portable drill can be attached without removing any part of the machine, which saves time and protects against the loss of parts.

The "Artisan" Universal Milling Machine

Strictly Modern—Remarkably Rigid—Extremely Accurate

Particularly adapted to the exacting requirements of the Toolmaker, Manufacturer, Vocational Instructor and Experimenter.



A FEW SPECIFICATIONS

Power Longitudinal Feed ..... 14"
Power Cross-Feed ..... 5"
Screw elevation of knee ..... 11"

Table 23" x 6", swivels 45 degrees, right or left.
Spindle (No. 9 B & S Taper) has extra large bearings.
Six spindle-speeds, thru direct and back-gears.
Self-contained friction-type countershaft.
Micrometer dials on all feed-screws.

Floor-space required ..... 50" x 36"
Net weight (Belt-driven) ..... 650 lbs.

Can be arranged either for belt-drive, or for motor direct-connected to the nearest light-socket.

For complete details and price, write

The Artisan Manufacturing Company
879 Hathaway Street CINCINNATI, OHIO, U. S. A.

In cylindrical grinding, the fineness or coarseness of the grinding wheel is not alone responsible for the quality of the finish obtained on the work. A fine finish can be obtained with a coarse-grained wheel if the proper work speed and traverse are used.

Pneumatic hammers should be carefully cleaned after using, and should be submerged in a tank of oil when not in use.

A GOOD Chest for YOUR Tools!

Keep your tools in working order, orderly arranged in a

GERSTNER TOOL CHEST

Saves time, money, worry.

Free catalog. 30 sizes; 12 styles.

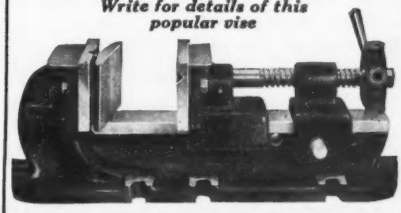
H. GERSTNER & SONS
1254 Columbia Street Dayton, Ohio

GEM DRILL VISE

Holds Work of Any Shape

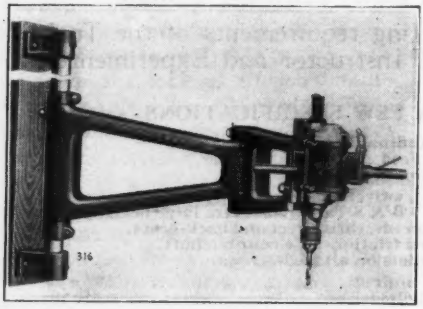
Gem Drill Vises are constructed to hold odd-shaped work. Hence, a special alloy metal of unusual gripping power; a swivel jaw, self-adjusting; V-grooves in the straight jaws. Through their ready adaptability to all types of work, Gems reduce setting-up time. Three sizes, up to 10½ inches. Circulars on request.

Write for details of this popular vise



J. E. MARTIN TOOL & DIE WORKS
550 W. State St. SPRINGFIELD, OHIO

The radial arm is mounted on an enclosed and dust-proof ball thrust bearing, which reduces friction to a minimum and permits quick and easy



Hisey Sensitive Radial Drilling Arm

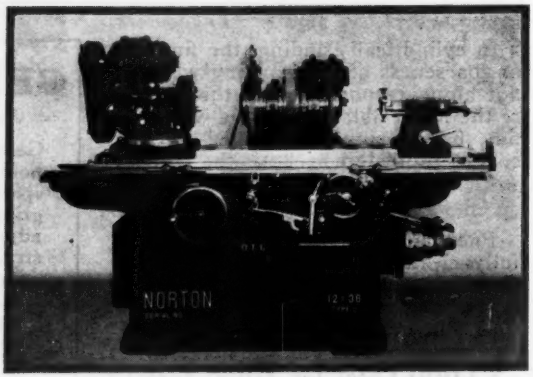
adjustment. Individual swivel clamps provide for locking either the long or short arms independently, or, if required, both arms can be locked in any fixed angular position. The maximum arm reach from the column to the drill spindle is 36¼ inches, and full arm length will swing through an arc of more than a half circle of 240 degrees.

The lever feed is operated through a rack and pinion in the same manner as a drill press, thereby affording a positive and sensitive control. The vertical adjustment by means of the lever is 7½ inches, while an adjustment of 25 inches can be obtained on the main column. The diameter of the main column is 2½ inches. Net weight, 215 pounds.

Norton 12x36-in. Universal Multipurpose Grinder

Extreme simplicity of construction and complete power control within itself are features of an improved 12 x 36-inch Universal Multipurpose Grinding Machine that has been announced by the Norton Company, Worcester, Mass. The machine is designed expressly for handling small lots of pieces that are too heavy for the tool grinder and in too small quantities to warrant the use of a heavy machine. The machine can be used for external, internal, and face grinding.

The new machine is absolutely self-contained, with three separate motors driving the headstock, wheel, and work table and pump, each motor being individually controlled. Complicated gearing, shafting and belting within the machine are entirely eliminated. Practically all of the important mechanisms are located on the outside of the machine where they are easily accessible, thus reducing maintenance to a minimum. Though essentially a light machine, it is rigidly built and will swing work up to 14 inches in



Norton 12x36-in. Universal Multipurpose Grinder

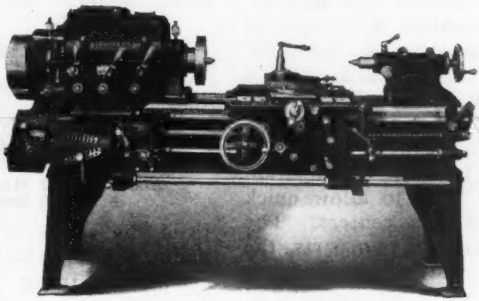
diameter and 37 inches in length. The headstock and wheel head are designed to permit a wide variety of pieces to be ground.

Both the headstock and wheel head are of the swivel type and are graduated on the base in degrees. Positions on the headstock are provided for

"Lehmann Lathes"

TWO STYLES
Three Step Cone and 16-Speed Geared Head

5 SIZES
16/18¼"
18/20¼"
20/22"
22/24¼"
24/27⅛"



ACCURATE POWEREUL TOOLS EMBODYING the most modern ideas in design and construction. Their performance is their best indorsement.

Ask Any User

CATALOG ON REQUEST

LEHMANN MACHINE CO.

3560 Chouteau Avenue, ST. LOUIS, U. S. A.

The Ball Expansion Hand Reamer

THE BALL-REAMER is different from the usual type of expansion reamer in that the body of the reamer is solid, with a pilot for guiding the reamer through the hole.

THE BODY of the reamer is hardened. The blades are set in the body of the reamer and are locked at each end by set screws.

THE BLADES are made of either carbon or high speed steel. The expansion of the blades in no way affects the truth of the body of the reamer as is the case in every type of expansion reamer where the body is split. Range of expansion, .030" to .045".

Catalogue on Request

The Schellenbach-Hunt Tool Co., 116 Opera Place, Cincinnati, O.

face grinding. The internal grinding spindle, which is mounted continuously on the double-ended wheel head, is brought into position by swivelling the wheel head around 180 degrees. Intermediate positions for external angular grinding are also possible. The headstock is provided with a chuck which can be attached to the spindle to handle work that is too small to handle on centers.

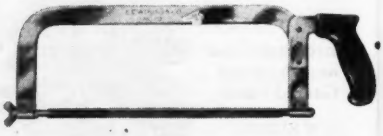
The footstock is of the combination lever and screw type, to allow quick changing of work on centers. The work table is made in two parts, the top pivoting on a stud in the center, and provision is made for clamping at both ends. The table is graduated in degrees for taper grinding, and also in feet. Eight speeds, ranging from 21 to 111 inches per minute, are available. The wheel feed, either automatic or hand, operates regardless of the position of the cross slide relative to the work table, and the wheel may be fed at any angle, any time. An automatic stop is provided to arrest the feed when the work is to size.

The reverse mechanism is the same as is used on all Norton cylindrical grinding machines, and is made very accurate for grinding close to shoulders. The pump is on the outside of the tank and is operated by a back shaft connected to the table traverse motor.

Atkins No. 12 Heavy Duty Special Hack Saw Frame

To meet the demand for a hack saw frame that will be heavy and extra strong, E. C. Atkins & Co., 404 South Illinois Street, Indianapolis, Ind., has brought out the No. 12 Heavy Duty Special Hack Saw Frame shown in the illustration. The back of the frame is made from 1 x ¼-inch heat-treated spring steel, and will not bend under strain. A fiber handle of the pistol-grip pattern is provided, and the frame is nicely balanced for easy cutting. A straight, horizontal handle can be supplied if desired.

The No. 12 frame is made to take 12-inch blades only, and is 5¼ inches

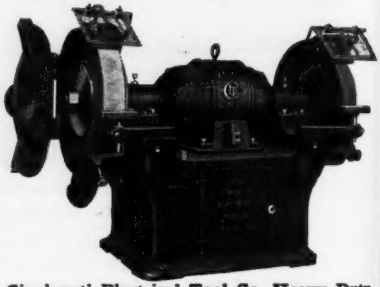


Atkins No. 12 Heavy Duty Special Hack Saw Frame

from the edges of the teeth to the under side of the back. The studs are extra strong and fitted to the frame in such manner that they cannot give when the thumb nut is tightened. The blade can be adjusted to cut in each of four positions. The frame is nickel-plated and polished. Frame furnished with one Atkins Silver Steel Hack Saw Blade.

Cincinnati Electrical Tool Co. Heavy Duty Floor Grinders

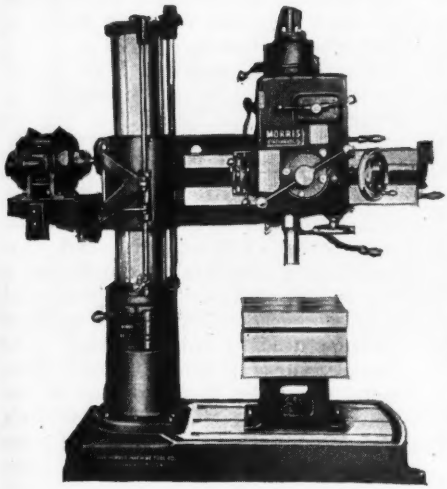
The Cincinnati Electrical Tool Co., a subsidiary of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, has brought out a line of heavy duty floor grinders which are especially designed



Cincinnati Electrical Tool Co. Heavy Duty Floor Grinder

for heavy grinding in foundries, railway shops, forge shops, steel mills, and other places where grinders are used continuously on heavy work. The one-piece spindle is of nickel alloy

MOR-SPEED—*A Better High Speed Radial Drill*



THE crowning achievement of 20 years' specialization in fine drill manufacture. Features include Timken Roller Bearings, hardened broached gears, heat treated multiple splined shafts and spindle, multiple disc clutch and positive lubrication.

Speed and feed changes are located in the head and changes made with convenient levers through sliding gears.

There are twelve speed changes ranging from 125 to 1600 R. P. M., and six feeds from .004 to .025 per revolution. Capacity for running a 3/8-in. drill at 80 feet per minute, and sufficient power to drive a 1 1/2-in. drill. Made in 3-foot and 4-foot sizes.

Write for Circulars

THE MORRIS MACHINE TOOL CO., Cincinnati, Ohio, U. S. A.

STEEL FORGINGS

Service ***Gear Blanks***

Manufacturing forgings of special alloy steels requires skill. Our work is all done by men who know steels and know how to fashion them into forgings that fit your specifications to the letter. Unquestionably, you can profit through the skill, the care, and the knowledge we have of forging. Forgings rough turned if desired.

THE STEEL FORGINGS COMPANY :: :: CINCINNATI, OHIO

steel, turned and ground accurately to size, and is mounted on four Timken tapered roller bearings which run in oil. The bearing mountings are of the newest type, and are grit and dust-proof. The bearings are adjustable to compensate for wear, and can be easily taken up.

The wheels are made with 10-inch bores, which both effects a saving in the initial cost of the wheels and reduces the discarded wheel losses to a minimum. Wheel flanges and nuts are machined so as to afford perfect balance with the spindle, insuring a minimum of vibration. Wheel guards are of cast steel, equipped with exhaust connections, and have 4-inch adjustments for wheel wear. Non-breakable, adjustable eye shields and chip breakers are provided over each grinding wheel.

Both motors and starter are fully enclosed, the starter being of the safety type, with both overload and undervoltage protection, and mounted in the base. A push-button control station is conveniently mounted on the motor frame. The grinders can be supplied for alternating current, 220-240 or 550 volts, 2 or 3-phase current, 115 or 230 volts.

Aloxite Large-Diameter Crank-Grinding Wheels

Vitrified Aloxite abrasive wheels of extra large diameter, especially designed for the grinding of crankshaft pins and bearings, are now being made by the Carborundum Company, Niagara Falls, N. Y. The wheels are made in 36-inch and 42-inch diameters, the 36-inch wheels being made in thicknesses down to 1¼ inch, and the 42-inch wheels being made in thicknesses down to 1½ inch. These wheels were developed to meet the needs of the automotive industry for wheels that would produce a maximum of production with a minimum of wear, and are, accordingly, of accurate dimensions and perfectly balanced. Such wheels will produce more accurate work than was formerly produced with the narrow-face wheels, and a better finish is obtained. The wheels can be adapted to all standard machines.

E. C. Atkins & Co. Catalog No. 20

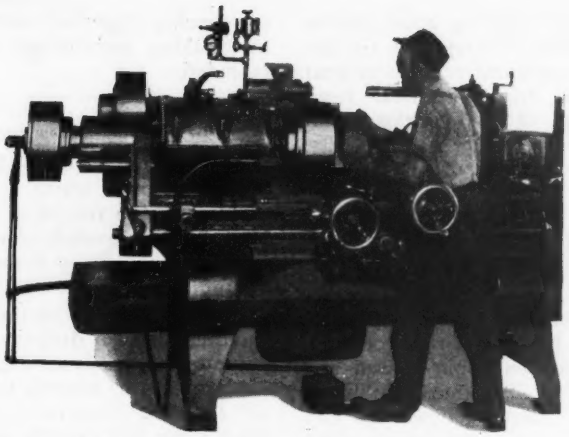
E. C. Atkins & Co., 404 South Illinois Street, Indianapolis, Ind., has published a new catalog, designated as No. 20, which describes in detail each item of the complete line of products manufactured by this company. The line includes all kinds of mill saws, metal saws, the hardware line of mechanics' saws, machine knives, trowels, and a complete assortment of saws and tools especially adapted for manual training schools.

Practically every kind and variety of tool made by this firm is illustrated, and complete lists of sizes and prices are included. Pictures of the company's dealer stores and repair shops in various parts of the country are also shown. The book contains 256 pages, 7 x 10 in. in size, with 133 illustrations, and is nicely bound in a cloth-board imitation of leather.

Cincinnati Gear Co. Catalog D

A catalog giving the dimensions of the various types and kinds of gears manufactured by this company has been issued by The Cincinnati Gear Co., Cincinnati, Ohio. The book includes sizes, descriptions and dimensions of angle gears, bevel gears, spur gears, spiral gears, non-metallic gears of various kinds, worm gears and worm wheels, rawhide pinions, sprockets, and racks. It also includes information that is of use generally to users of gears, such as table showing the horsepower of various kinds of gears, proportions of various types of

LOGAN



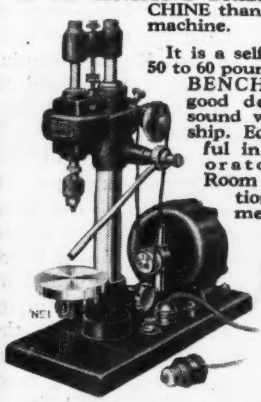
LOGAN

There is a "Logan" Air Operated Device adaptable to all types of production machines, to meet every work holding requirement; fully described in the "Logan" catalog, sent on request.

LOGANSPORT MACHINE CO., Logansport, Ind.

Small Drilling

and many other vertical operations are performed more economically on the A. M. SENSITIVE DRILLING MACHINE than any other machine.



It is a self-contained 50 to 60 pound portable BENCH UNIT of good design and sound workmanship. Equally useful in the Laboratory, Tool Room or Production Department.

For its complete story ask for Booklet C.

ADOLPH MUEHLMATT
Fifth and Elm. S.E., Cincinnati, O.

TWENTIETH CENTURY BALANCING TOOL

Always on the level

The most practical, sensitive and inexpensive device manufactured for balancing pulleys, cones, armatures, fly wheels, polishing wheels, etc. Will set anywhere and is easily portable. In sizes up to 24,000 pounds capacity.

Ask for the Bulletin

Sundstrand Machine Tool Co.
ROCKFORD, ILL.

gears, rules for ordering gears, metric conversion table, horsepower of leather belting, comparative sizes of gear teeth, natural trigonometrical functions, table for calculating the speeds of pulleys, and so on. The book has 132 5 x 7½-inch pages. Copy sent on request.

Westcott Catalog No. 528

The Westcott Chuck Company, Oneida, N. Y., has issued Catalog No. 528, which contains descriptions, illustrations, and price lists of the combination, independent, spur-geared universal, two-jaw, "Little Giant," and other chucks manufactured by this firm. Tables are given which show the dimensions and capacities of the various sizes of chucks, and instructions concerning the care and handling of chucks, together with directions for making and fitting adapters, are included.

(*Continued from page* 32)

controlled and recorded by the use of a pyrometer in which a pen automatically traces a record of the heat during a 24-hour period. A control on the pyrometer is set to control the valve through which fuel or current is fed to the furnace, and as the temperature of the furnace drops or rises, the valve opens or closes accordingly. By examining the record, which is done at frequent intervals, the man in charge can tell exactly what is taking place in the furnace and any abnormal condition can be corrected before any damage is done.

(*Continued from page* 10)

the piston ready for the grinding operation.

Air compressor heads are drilled in the Natco multiple drilling machine, shown in Fig. 10. Twelve ⅞-inch holes are drilled through 1¾ inches of cast iron at a rate of twenty-five per hour.

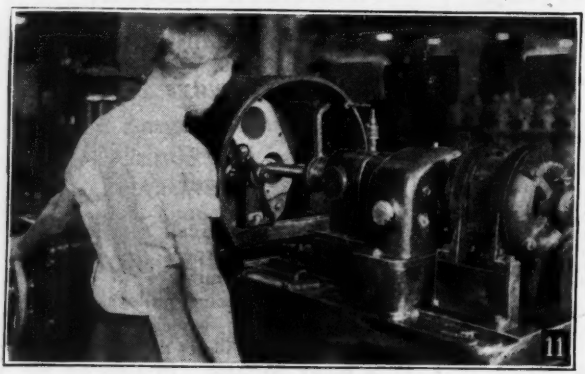
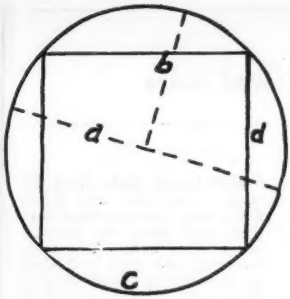


Fig. 11—Cylinder blocks are ground in a "Teromatic" automatic grinder.

The extent to which the most modern machinery has been adapted for service in this plant is shown by reference to the illustration, Fig. 11. Here an air compressor cylinder with two bores is shown in process of being finished on a "Teromatic" grinder. The bore is 7 7/8 inches long, contains .012 inch of stock, and is finished to size with a tolerance of .001 inch, the time being one-half hour for the two holes. A 60-K carborundum wheel is used, and the job is kept cool by a flood of kerosene oil. It has been found that kerosene keeps the casting cool and keeps the wheel sharp to such an extent that it is possible to rough and finish the bore complete at one setting, thus eliminating one operation. The automatic plugging mechanism precludes the possibility of grinding the hole oversize, saves time which would otherwise be lost in gauging the hole, and stops the machine the instant the hole is finished.

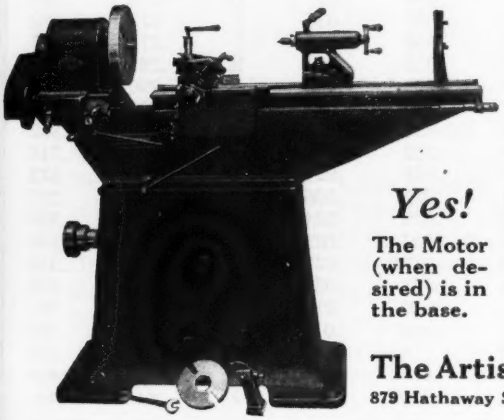


Mensuration Factors

The circumference (c) of a circle equals the diameter (a) x 3.1416.
The area of a circle equals the square of the diameter x .7854.
The area of a circle equals the square of the radius (b) x 3.1416.
The area of a circle equals the square of the circumference (c) x. .0796.
The diameter of a circle equals the circumference x .3183.
The side of an inscribed square (d) equals the diameter x .70971.
The side of an inscribed square equals the circumference x .2251.
The side of a square of equal area equals the diameter x .8862.
The side of a square of equal area equals the circumference x .2821.
The diameter of a circumscribed circle (a) equals side of a square x 1.4136.
The circumference of a circumscribed circle equals side of square x 4.443.
The diameter of a circle of equal area equals side of square x 1.128.
The circumference of a circle of equal area equals side of square x 3.574.

THREE ACES! (and we're not bluffing)

"Artisan" Lathes, now offered in three distinct types, unquestionably represent the greatest values obtainable in the small lathe field.



HERE IS THE
11" x 5' MASTER

11" Swing over Bed
16" Swing over Gap
36" Between Centers
1-5/16" Hole thru Spindle

Yes!
The Motor (when desired) is in the base.

Can be supplied with plain or compound rest, and either loose or quick-change gears.

Full particulars upon request. Don't Delay. Write today!

The Artisan Mfg. Company
879 Hathaway St. Cincinnati, Ohio, U. S. A.

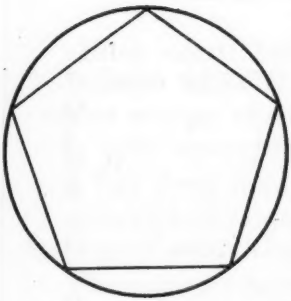
Table of Twist Drill and Drill Rod Sizes

Number of Twist Drill and Drill Rod	Size of Drill in Decimals	Size of Drill Rod in Decimals	Number of Twist Drill and Drill Rod	Size of Drill in Decimals	Size of Drill Rod in Decimals
1	.228	.227	41	.096	.095
2	.221	.219	42	.0935	.092
3	.213	.212	43	.089	.088
4	.209	.207	44	.086	.085
5	.2055	.204	45	.082	.081
6	.204	.201	46	.081	.079
7	.201	.199	47	.0785	.077
8	.199	.197	48	.076	.075
9	.196	.194	49	.073	.072
10	.1935	.191	50	.070	.069
11	.191	.188	51	.067	.066
12	.189	.185	52	.0635	.063
13	.185	.182	53	.0595	.058
14	.182	.180	54	.055	.055
15	.180	.178	55	.052	.050
16	.177	.175	56	.0465	.045
17	.173	.172	57	.043	.042
18	.1695	.168	58	.042	.041
19	.166	.164	59	.041	.040
20	.161	.161	60	.040	.039
21	.159	.157	61	.039	.038
22	.157	.155	62	.038	.037
23	.154	.153	63	.037	.036
24	.152	.151	64	.036	.035
25	.1495	.148	65	.035	.033
26	.147	.146	66	.033	.032
27	.144	.143	67	.032	.031
28	.1405	.139	68	.031	.030
29	.136	.134	69	.029	.029
30	.1285	.127	70	.028	.027
31	.120	.120	71	.026	.026
32	.116	.115	72	.025	.024
33	.113	.112	73	.024	.023
34	.111	.110	74	.0225	.022
35	.110	.108	75	.021	.020
36	.1065	.106	76	.020	.018
37	.104	.103	77	.018	.016
38	.1015	.101	78	.016	.015
39	.0995	.099	79	.0145	.014
40	.098	.097	80	.0135	.013

This handy table gives the sizes of number and letter drills and the corresponding drill rod sizes in decimal parts of an inch. The table showing the drill rod sizes is the Stubs Steel Wire Gage table, which is used in measuring drawn steel wire or drill rods made by Stubs. It has been adopted as standard by American manufacturers of drill rods.

Letter Size of Twist Drill and Drill Rod	Size of Drill in Decimals	Size of Drill Rod in Decimals
A	.234	.234
B	.238	.238
C	.242	.242
D	.246	.246
E	.250	.250
F	.257	.257
G	.261	.261
H	.266	.266
I	.272	.272
J	.277	.277
K	.281	.281
L	.290	.290
M	.295	.295
N	.302	.302
O	.316	.316
P	.323	.323
Q	.332	.332
R	.339	.339
S	.348	.348
T	.358	.358
U	.368	.368
V	.377	.377
W	.386	.386
X	.397	.397
Y	.404	.404
Z	.413	.413

Table of Regular Polygons



THE usual method of laying out figures of this kind is to draw a circle and space off the points with a divider, but a lot of time can be saved if we know the exact dimension of the spacing or the correct diameter of the circle necessary to obtain a figure of the size desired. By using this table, guesswork is eliminated and the correct dimensions are obtained at once.

As an example, let us suppose that we wish to lay out a pentagon, or five-sided figure, with sides ⅞ inch long. Opposite "Pentagon," we find 1.7012 as the diameter of a circle that will exactly enclose a pentagon having a side equal to one. As the side of our figure is to be ⅞ inch, we multiply 1.7012 by ⅞, which gives us 1.488 inch as the diameter of the circle to draw. Then with the dividers set at ⅞ inch we space off the points on the circle, and if the job has been done right the spacing will come out equal. Connect the points by straight lines, and the pentagon is finished.

Number of Sides	Name of Figure	Diameter of Circle that will just enclose when side is 1	Diameter of Circle that will just go inside when side is 1	Length of side where diameter of enclosure circle equals 1	Length of side where inside circle equals 1	Angle formed by lines drawn from center to corners.	Angle formed by outer sides of figures	To find Area of Figure multiply side by itself and by number in this column
3	Triangle	1.1546	.5774	.866	1.732	120°	60°	.4330
4	Square	1,4142	1.	.7071	1.	90	90	1.
5	Pentagon ...	1.7012	1.3764	.5878	.7265	72	108	1.7204
6	Hexagon	2.	1.732	.5	.5774	60	120	2.5980
7	Heptagon ...	2.3048	2.0766	.4338	.4815	51°-26′	128 4/7	3.6339
8	Octagon	2.6132	2.4142	.3827	.4142	45	135	3.4284
9	Nonagon	2.9238	2.7474	.342	.3639	40	140	6.1818
10	Decagon	3.236	3.0776	.309	.3247	36	144	7.6942
11	Undecagon ..	3.5494	3.4056	.2817	.2936	32°-43′	147 3/11	9.3656
12	Dodecagon ..	3.8638	3.732	.2588	.2679	30	150	11.1961

Index to Advertisements

	Page
Atkins & Co., E. C.	First Cover, 37
Acme Machine Tool Co.	43
Armstrong Bros. Tool Co.	6
Artisan Manufacturing Co., The	51, 59
Barnes Co., W. F. & John	29
Boye & Emmes Machine Tool Co.	19
Bradford Machine Tool Co.	33
Buffalo Forge Co.	49
Cincinnati-Bickford Tool Co.	17
Cincinnati Gear Co.	Third Cover
Cincinnati Planer Co.	41
Cincinnati Shaper Co.	4
Cisco Machine Tool Co.	39
Formica Insulation Co., The	31
Fosdick Machine Tool Co.	23
Fountain Equipment and Manufacturing Co.	47
Gerstner & Sons, H.	51
Hisey-Wolf Machine Co.	1
LeBlond Machine Tool Co.	13
Lehmann Machine Co.	53
Logansport Machine Co.	57
Martin Tool & Die Co., J. E.	51
Monarch Machine Tool Co.	25
Morris Machine Tool Co.	55
Muehlmatt, Adolph	57
National Automatic Tool Co.	21
Norton Company	11
Oesterlein Machine Co.	27
Rahn-Larmon Co., The	45
Schellenbach-Hunt Tool Co.	53
Scully-Jones & Co.	Second Cover
Steel Forgings Co.	55
Sundstrand Machine Tool Co.	57
United States Drill Head Co.	47
United States Electrical Tool Co.	Fourth Cover

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Raver-in-Chief

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Ev'ry Home's Gottem

Here an' there is useta be,
You could find a quiet zone,
Now where you find no radio,
You find a saxophone—

Tis Dem Hard To Tell Which Is The Hardest Thing To Get Our Fliv Around On The Pike — A Farmer Comin' In On A Load O' Hay Or A Bird On A Motor "Sike" With A Bobbed Hair Jane Ridin' On Behind—

Some Price—Glory

"We glory in the spring"
The pòor sap poets are wheezin'
But where that hull's tha glory
O' sniffin' and o' sneezin'?—

Paw Says If Woman Isn't Understood It Ain't 'Cause She Don't Talk Loud Enough—

The easiest thing to find is lost motion.

An' We Fall For Ut

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They mark 'em "40 Bucks,
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The Riot's On

Paw's sore cause maw gotta bob,
The amosphere is muggy,
She says caus he's a jack ass,
She'll be no horse an' buggy—

The one thing better than faith is knowledge.

Some Of The Movie Stars Will Have To Pose Over Time If They Expect To Figure In As Many Weddings On The Screen As Off—

Why The Yowl?

If the Wets know we'r wetter,
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What we wanta know is why
We all ain't satisfied?—

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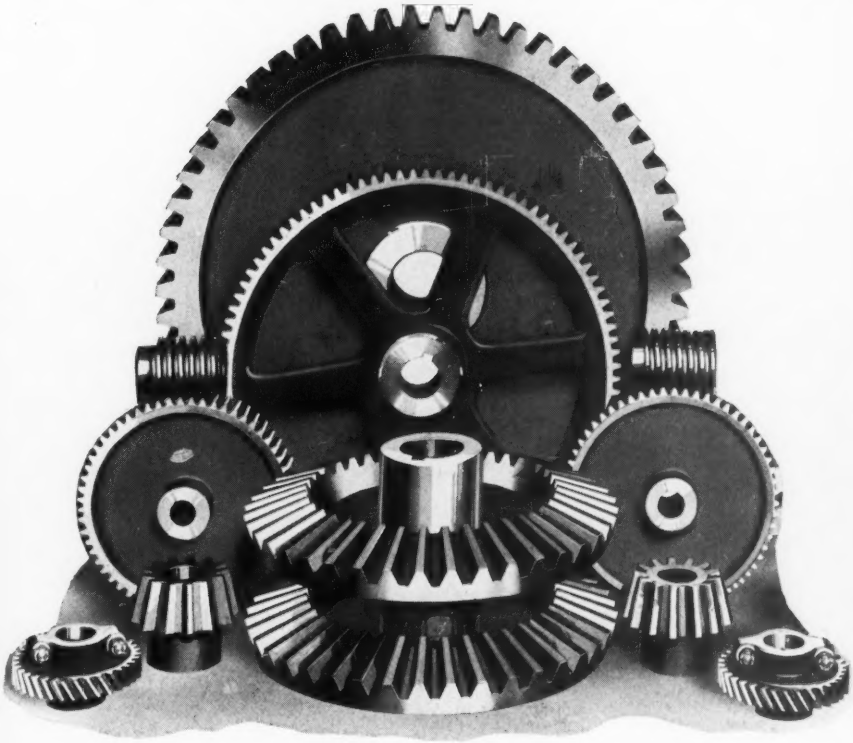

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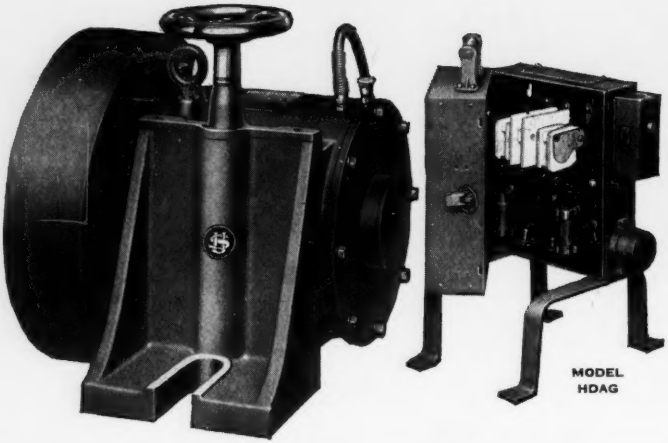

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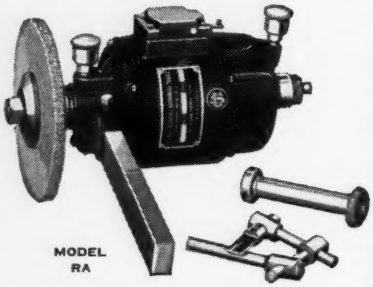

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